The Dock and Harbour Authority

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Editorial Comments

Mobile: the Port of Alabama.

The State of Alabama, commonly known as "the Cotton State," one of the South-eastern states of the American Union, possesses a rather curious outline. Lying to the North of Florida, it is shaped roughly as a rectangle, between Georgia on the East, Mississippi on the West and Tennessee on the North, with a peculiar excrescence, also roughly rectangular, at the extreme South-western corner, enclosing Mobile Bay. Its area of 52,000 square miles is almost entirely land-locked and the State's limited access to the Gulf of Mexico constitutes a kind of narrow corridor with a wedge-shaped inlet from the sea. Upon the Western side of this inlet, lies the sole port of Alabama, Mobile, which forms the subject of this month's leading article.

As a member of the group of states which temporarily seceded from the American Union in 1861, resulting in the Civil War between North and South, Alabama acquired considerable notoriety in connection with the dispute between America and Great Britain on the question of blockade. This dispute was ultimately settled by the Alabama Arbitration, into the merits of which there is no occasion to enter here. Mobile, at that time, was a flourishing port, with exports of cotton reaching a million bales annually and of corn to an annual extent exceeding 30 million bushels. Since that era, a transformation has taken place in the industrial character of the State, through the outstanding development of its enormous mineral resources. These are comprised in two regions: the South-eastern Gold Belt, which yields gold, copper, pyrites and mica; and the three North-western coalfields, separated by narrow valleys, in which are found bauxite, barytes, iron ore and limestone. The wealth of the districts is almost unbelievable: the estimated resources of the coal fields are over sixty thousand million tons of coal. This, naturally, has had its effect on the trade of Mobile, though cotton still continues to be one of the leading exports, in conjunction with timber, lumber, and iron and steel products.

Although occasionally subject to atmospheric disturbances (a hurricane in 1906 did damage to property to the extent of five million dollars), Mobile enjoys a sheltered position on the waters of Mobile Bay with a vast hinterland, rich as above stated, and served by an efficient system of internal waterways. This is extremely favourable for the development of its commerce, inland as well as overseas, and the account of the notable progress of the port during the past and present centuries should prove to be of interest.

Port Reconstruction.

The topic of post-war reconstruction is occupying a good deal of public attention at the present time. This is quite right, provided attention is not thereby diverted from the supremely urgent duty of winning the war. It is to be hoped, however, when plans are matured to the point of formulation, that ports in this country, which have all more or less suffered heavily in consequence of hostile attack, will receive their due share of consideration in conjunction with the general arrangements of civic re-planning. There is admittedly room for improvement in the existing order of things. The port and the municipality with which it is linked in close contiguity, have cogent claims to be treated as a single entity and an appropriate lay-out should be devised to unite them with a common standard of treatment.

In this connection, passenger ports stand out pre-eminently. Our readers will hardly need to be reminded of the emphasis we have always laid on the necessity for a higher architectural treatment of British maritime stations, in order to bring them into line with corresponding installations on the Continent of Europe. There is scope, moreover, for the individualistic touch, and it would be appropriate to introduce some characteristic feature which would make an appeal to public and national sentiment.

For instance, speaking at a luncheon given a month or two back by the Southampton Chamber of Commerce, Mr. Harold Butler, Civil Defence Commissioner for the Southern Region, referred to the Statue of Liberty at the entrance to the Port of New York and said that it stood to welcome every visitor to the United States in the name of Freedom and that it offered liberty to all who sought it on American shores. "Southampton," said Mr. Butler, "is one of the great gateways of England and I hope the future Southampton will become the port by which every visitor from overseas will wish to enter in order to pay homage to its new dignity and beauty. I should like to see a Statue of Deliverance welcoming every visitor to England for centuries to come in the name of the delivery of the world from fear of tyranny which this country will have accomplished by its exertions and by its example when Germany is finally defeated. It will be there to greet all those who fought and fell with us, standing as a symbol of England, a country of free men who have once more won for themselves and the world the right to be free."

The aspiration so appropriately expressed by Mr. Butler, has been endorsed within the past month at a gathering of architects in Southampton, held under the auspices of the Regional Reconstruction Committee for Civil Defence. The President of the Hampshire and Isle of Wight Architectural Association said he hoped the town would be re-planned so that it would become "a fit Terminus to the Atlantic Crossing and the Empire." The ideal behind this typical case might be adopted with advantage at other ports in the United Kingdom.

National Dock Labour Corporation.

The experimental port labour schemes, now in operation at Liverpool and Glasgow, and understood to be working satisfactorily, have been followed up within the past month by the inauguration of a new body, to be known as The National Dock Labour Corporation, Ltd., which will be charged with the promotion, financing and administration of certain other new schemes of dock labour, to be introduced, immediately after approval, at London and the principal ports on the Bristol Channel, Firth of Forth, Humber, Tees, Tyne and Wear.

The proposed arrangements are set out in detail in the terms of a Ministerial Order and statement to be found on another page in this issue, to which our readers are referred for full information on the matter. The Order is undoubtedly a definite step forward in the direction of the regularisation of quayside employment and the decasualisation of dock labour; and, as such, it should be welcomed by the employers as well as by the men themselves. Doubtless, there will be some respects in which the local schemes, after trial, will show themselves capable of improvement, but the general principle is satisfactory and will commend itself for approval. The terms under which the dock labourer will, in future, be employed are certainly to his advantage, though it is to be noted that the wages standard is distinctly lower than in the Mersey and Clydeside schemes, which indeed, may be considered rather unnecessarily high, and likely to lead to invidious comparisons. The rising scale of port charges, too, is having an unfortunate effect on the prices of commodities, and consequently on the cost of living.

Dishonest Dock Labour Practices.

A salutary lesson was given to fraudulently minded quayside workers at the Liverpool Quarter Sessions on August 6th, when nine dock labourers, charged with obtaining money by false pretences from the Minister of War Transport, were smartly fined

Editorial Comments—*continued*

for the offence, after which the Recorder uttered a stern warning that future offenders would meet with no leniency. The men, with the aid of a false rubber stamp used on their employment cards, had been able, or had attempted, to draw wages under the new weekly dock workers' wage scheme, without putting in the requisite appearance at the dock employment centre.

The minimum wage for dock labourers was devised to secure them a guaranteed weekly payment, whether actually working or not, subject to the putting in of 11 attendances weekly. The falsification of attendances would obviously wreck the entire scheme and make it a fruitful means of acquiring money by fraud and dishonesty. Such practices, we are sure, will be reprobated by the great majority of dock labourers, in the furtherance of whose interests the scheme was devised.

It is unfortunate that the evil has manifested itself to such an extent that Mr. J. Gibson Jarvie, the North West Regional Port Director, has found it necessary to issue a broad-sheet appeal, in which he asks for " a square deal " to the shipowners and employers as well as to the dockers. He adds: " It also means a square deal to the Government and to the country and to the community. To the ' good ' docker, I intend that his mates shall do their fair share, that slackers who are resting on the good dockers will go, that looters and pilferers and thieves, who are ruining the reputation of the decent docker will go. . . . If you play up, we can do a grand job for the country."

The pity of it is that such an appeal should be necessary at a time when everybody ought to realise the imperative importance of doing their utmost to help in a national emergency of unprecedented intensity. Happily, the response generally throughout the country has been all that could be desired, and it is to be hoped that quayside labour will equally respond to the call of duty.

Use of Graving Docks for Shipbuilding.

The obvious purpose of graving docks, as their name implies, is for the purpose of overhauling and repairing the keels of ships, but latterly they have been brought into service for the actual process of shipbuilding, thus usurping the functions of the normal shipyard slipway. There is, of course, nothing inherently objectionable to this extension of the utility of graving docks, except in so far as it may reduce the limited means available for executing ship repairs.

At the present time, however, there is so great a demand for new shipping tonnage that the existing shipyard stocks are unable to cope with it, and, in the United States, where enormous shipbuilding programmes are in hand, some 30 new ships, recently ordered, are, it is stated, to be built in dry or graving docks, or, as an equivalent, within excavated enclosures on a river bank protected by a cofferdam. Apparently, so far, the method has only been applied in this country to the construction of a single vessel, and that an experimental concrete ship of some 2,000 tons.

One of the advantages claimed for graving docks as shipbuilding sites is that they allow of the complete construction of the ship before she takes the water, or rather before water is admitted to the chamber in which she is lying, whereas in slipway construction as a rule, vessels leave the stocks with a considerable amount of structural work remaining to be done. The process, too, of floating a vessel out of a dock, or chamber, by the admission of water thereto, is attended with less trouble and risk, than when the vessel has to slide down timber ways under her own imperfectly controlled momentum.

A dock enclosure is at present under construction on the banks of the River Delaware, near Philadelphia, U.S.A., with a length of 1,500-ft., a width of 150-ft. and a depth of 65-ft. It is to be used for the construction of a 60,000-ton battleship, and will be excavated to a depth of 40-ft. below the adjacent river water level, so that, on completion, the vessel will be able to float out unimpeded at its own immersion depth.

The Canadian Harbours Board.

The Annual Report for the financial year 1940 of the National Harbours Board of Canada, extracts from which are to be found in the current issue of this Journal, furnishes an interesting comparative statement of the financial position of the ten leading port and harbour undertakings in Canada in 1935, when the Board was first formed, and at the present time, after five years working under the new system. Despite the fact that there is still a net income deficit of about 4 million dollars, this is a marked improvement on the $5\frac{3}{4}$ million dollar deficit of five years ago. Operating revenues are shown to have increased in the aggregate by 35 per cent., while operating expenses, notwithstanding a pronounced increase in the harbour activity, have decreased by 15 per cent. Operating income, accordingly, has risen from $2,451,699 to $5,823,163, a gain of $3,371,464, or 137 per cent. Out of this, however, there have to be provided heavy interest payments on loans from the Dominion Government and substantial reserves for replacement, the latter of which are now at a higher rate than in 1935. After making these allowances, the net result in 1940, though still on the debit side, is more favourable than in 1935 by upwards of $2,800,000.

The record for the period is eminently satisfactory and reflects much credit on the Board of Management which consists of three members. Indeed, it might even be used as an argument in favour of the adoption elsewhere of the nationalisation of port undertakings. But such a generalisation would hardly be legitimate. It has to be recognised that conditions in different countries vary to such an extent, that it would scarcely be safe to lay down a common standard of administration for all. Each country must determine for itself the kind of administration which is best suited to the temperament and genius of its nationals.

Seamen's Welfare at Ports.

Although not figuring prominently among the activities of port authorities in comparison with the paramountcy of their commercial functions, there is none the less an important and essential responsibility devolving upon them in regard to the care and welfare of seamen who visit their ports. This obligation has been recognised in various forms in the past, but latterly it has acquired enhanced importance by reason of war-time conditions and the moral compulsion of making adequate provision for the safety and comfort of seamen, who, after braving the perils of ocean voyages in the service of their country, are certainly entitled to its warm interest and regard.

In October last year, the Minister of Labour and National Service appointed a Seamen's Welfare Board to advise him on all matters relating to the welfare of British, Allied and foreign seamen in British ports and of the crews of British ships in overseas ports. On the recommendation of this body, port welfare committees have been appointed at the leading ports of this country, and these, working in conjunction with voluntary organisations, have been rendering excellent service. Steps are being taken at most ports to improve the accommodation provided for seamen ashore and to provide amenities and comforts at hostels, including contact and fellowship with landsmen through the medium of local clubs and sports associations. Assistance is also given with information as to suitable lodgings and places of amusement, while, in the case of torpedoed crews, clothing and temporary homes are found for them.

The movement has spread far afield and in New York, a new British Merchant Navy Club was opened on March 26th last by Lord Halifax. The club is provided with a lounge, library, reading room, games room and canteen. There is also a special room for officers. Similar interest is being displayed at other American and Canadian ports.

The spirit of the movement is so praiseworthy that it is sure to command the whole-hearted approval of all port authorities, and it can confidently be asserted that any reasonable outlay incurred in promoting the welfare of seamen at ports is fully justified and should be looked upon as ranking at least *pari passu* with other items of port working and equipment. In the last resort, the prosperity of ports depends upon the exertions and devotion to duty of those who man the ships.

A Scandinavian Marine Tunnel.

A project of notable importance has been put forward by a Danish engineering firm. It is for the construction of a tunnel under The Sound, 12 kilometres (13,000 yards) in length, between Amager, the island on which part of the City of Copenhagen is situated and Limhamn to the south of the Port of Malmö, the route lying by way of the Island of Saltholm. The scheme is propounded as a means of dealing with the considerable volume of traffic passing between the Scandinavian Peninsula and Denmark, in an alternative manner to the various ferry services which are liable to interruption and delay under adverse weather conditions. The cost of the work is estimated at 120 million kroner and the period of execution is put at six years.

In technical detail, the proposal is that the tunnel should be constructed of reinforced concrete tubes in sections of 50 metres length, weighing about 3,000 tons, which would be laid in a specially dredged channel. The problem of ventilation would be solved by means of towers, or shafts, projecting above the water level of the Sound.

If it matures, the installation will form an interesting supplementary undertaking to the Storstrom Viaduct, between the Danish islands of Seeland and Falster. This has a length of 10,535-ft. and was described in the issue of this Journal for October, 1937.

Modified Load Limits for Ships.

New Defence Regulations have been made in regard to the loading of ships. They provide in brief that ships may load to their tropical load lines instead of their summer lines, when the latter are applicable under the existing Load Line Rules, and to their tropical fresh water lines instead of their tropical lines, when the latter are applicable under the rules. The Regulation applies, in general terms, to all ships registered in the United Kingdom and to certain Colonial (but not Dominion) ships. It is not intended that the scheme should operate for more than a year, on the expiry of which the matter will be further considered.

The Port of Mobile, Alabama, U.S.A.

A Rapidly-developing Gulf Port

Location and Hinterland

MOBILE, "City of Six Flags" and the sole port of the State of Alabama, U.S.A., lies on the West side of Mobile Bay, which is 32 miles long with an average width of 16 miles, in a land-locked harbour, protected in the West by the mainland, on the East by Blakeley Island and on the South by islands of spoil deposited in the process of dredging the ship channel. Artificial protection is afforded by the mole at Arlington.

General cargo being discharged from ship at Alabama State Docks and Terminals.

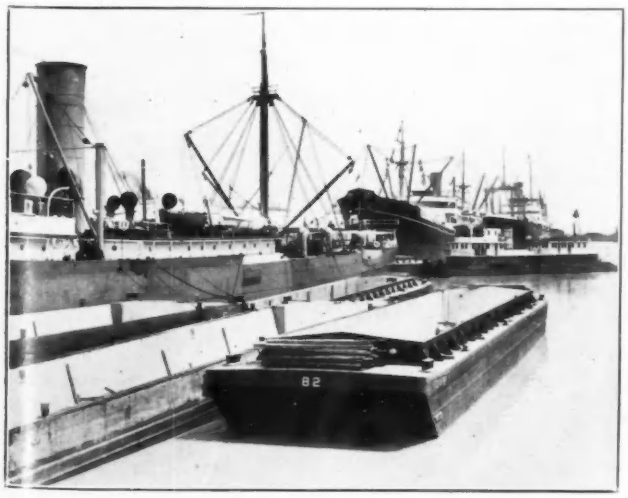
Mobile Bay is the outlet of the second greatest inland waterway system of the United States. The Mobile River which discharges into the Bay is a combination of two important trunk rivers, the Alabama and the Tombigbee, which meet at a point about 45 miles above Mobile. The former is the chief river of the State and itself is formed by the junction of the Coosa and Talapoosa rivers, which unite about 10 miles above the City of Montgomery. Altogether, the navigable waterway formed by the Mobile River and its tributaries extends to 460 miles from the mouth.

The territory behind Mobile and in the State of Alabama contains vast deposits of coal and iron, together with a wealth of timber forests. Moreover, there are many sources of power supply available.

Origins and Early History

To go right back to the earliest foundation of Mobile would involve a lengthy historical journey. Its records can be traced for some 230 years to the date 1711, when Jean Baptiste Le Moyne, Sieur de Bienville, established Fort Louis de la Mobile on the site where stands the flourishing city of to-day.

But if the question were asked when the potential importance of Mobile first dawned on the minds of mariners, various earlier dates could be given, one as far back as 1497, or thereabouts, more than 200 years before the establishment of Fort Louis de la Mobile, when Americus Vespucius visited the Gulf Coast and prepared a map clearly showing the harbourage possibilities of what is now known as Mobile Bay. The Bay is outlined on the map with Dauphin Island and Little Dauphin guarding the entrance and two large rivers flowing into the Bay from the unexplored interior. The Vespucian map was made in Lisbon in 1501 and is now, it is stated, in Rome.



Vessels at the Alabama State Docks and Terminals. In the foreground the vessel is taking steel plates and rails direct from barges.

Alonzo Pineda's ships entered the Bay in 1519, 29 years after the discovery of the West Indies by Columbus. Then there followed scattered visits of European adventurers in quest of alleged stores of gold. This was the chief thing which attracted them. They cared little for the intrinsic value of the country and its products.

The first colony of settlers was planted on Dauphin Island in 1699, by Le Moyne d'Iberville, a French naval officer who with his brother Bienville gradually extended their holding to the Back Bay of Biloxi, Mobile and New Orleans, leading to the development of the great territory, subsequently known as Louisiana.

The first seaport of this colonial enterprise was not in Mobile Bay, but in an excellent natural harbour found between Dauphin and Pelican Island, immediately to the South. Later, a storm caused the entrance to become blocked with sand and finally, a safe and permanent harbour was obtained in Mobile Bay.

Modern Development

Coming to more recent times, Mobile had attained a considerable degree of importance prior to the American Civil War, being then one of the most active ports in cotton and lumber in the Southern States. By the year 1878, the Government had completed a harbour approach channel with a depth of 13-ft., a work which had taken 8 years to carry out. The approaches to the port were, in fact, the foremost consideration, and their improvement a prime necessity, if the port was to flourish. The Choctaw Pass and the Dog River Bar, which had formerly a depth of little more than 5 and 8-ft. respectively, were deepened to 17-ft. by 1882, at which period a programme for providing a 20-ft. channel right through the Bay was being undertaken.

The Office Building and Grounds, Alabama State Docks and Terminals.

In February, 1901, improvements had so far progressed that there had been achieved a 23-ft. channel varying in width from 200-ft. in the Lower Bay to 40-ft. in the Upper Bay and 80-ft. in the Mobile River.

The fiscal year ended June, 1901, was notable for two interesting trade developments. For the first time, exports from Mobile to Central and South America exceeded those to Europe and exports from Mobile to Cuba stood second only to those from New York to Cuba.

Mobile had, in fact, gained recognition as an export port for Latin America. As against this, its cotton trade was decreasing and although port business as a whole was increasing, the city was losing business through lack of port terminal facilities. The port had no deep water wharves, it was chiefly dependent on anchorage in the Bay and the warehousing accommodation was altogether inadequate.

Contemporaneous photographs showed shipping at anchor in the stream loading timber from rafts through the bow ports or taking timber on deck from barges. It was generally agreed that terminals, wharves and warehouses were imperatively needed to enable the port to make progress.

By the year 1907, construction of the Turner Terminal Docks, the addition of Piers Nos. 1 and 2 by the Mobile and Ohio Railroad and Piers Nos. 4 and 5 by the Southern Railroad and other features, including the present municipal wharf erected by the City, had partially remedied the situation. But more was required.

Port of Mobile, Alabama, U.S.A.—continued

State Aid for Port Development

The City of Mobile, which had been in financial difficulties in the past (it had been bankrupt in 1873) found itself unable to embark on enterprises involving large capital outlay. It was not until the passing of the Rivers and Harbours Act of March 2nd, 1919, that the way became open for State assistance. In this Act " it is hereby declared to be the policy of The Congress that water terminals are essential at all cities and towns located upon harbours and navigable waterways and that, at least, one public terminal should exist, constructed, owned and regulated by municipality or other public agency of the State and open to the use of all on equal terms." This Congressional statement contained an implied promise that if the State of Alabama would do its part to provide Mobile with proper terminal facilities, the Federal Government would provide a proper entrance to the terminals.

In 1922, after considerable controversy and an opposition which was only overcome by the strenuous exertions of a Port Committee, the voters of Alabama ratified a Constitutional Amendment which enabled the State to issue $10,000,000 bonds for the construction of an ocean terminal system at Mobile, to be owned and operated by the State of Alabama. In the following year, a State Docks Commission was appointed to administer funds and commence work on the project. The Legislature authorised an initial issue of $5,000,000 bonds.

Formation of Port Authority

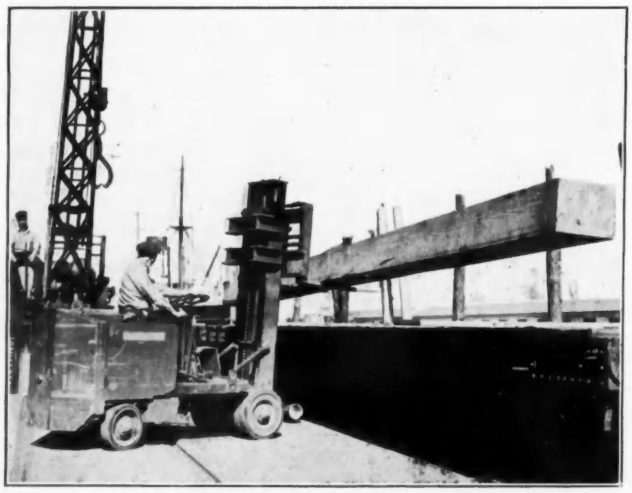
The State Dock Commission was organised as the Port Authority for Mobile under the chairmanship of Major-General William L. Sibert, U.S. Army (retired), a distinguished member of the Corps of Army Engineers. The other members were ex-Governor Charles Henderson, of Troy, and Frank G. Blair, of Tuscaloosa. The Authority proceeded to take definite steps for the development of the port, and in 1924-5, a site of 550 acres along Mobile River, South of Three Mile Creek, having been acquired by purchase and exchange of properties with the Louisville and Nashville Railroad Company, the first contract for a unit in the State Docks system was let.

As the works progressed, they were brought into service and in 1926, a cotton handling installation was put into commission. It included waterside warehouses, and transit sheds with a high-density cotton compressor, having a capacity of 120 bales per hour.

In 1927, a second issue of $5,000,000 of Port Improvement Bonds was authorised by the Legislature. The following year was marked by the formal dedication by Governor Bibb Graves of the Alabama State Docks.

Other important port installations which have come into existence are a large cold storage plant and fruit terminal; special equipment for handling heavy cargo; new cotton compressors and warehouses; a store for fertilisers and bulk chemicals, a new and modern Quarantine Station; a new depôt for the United States Lighthouse Service and extensive improvements to the United States Marine Hospital.

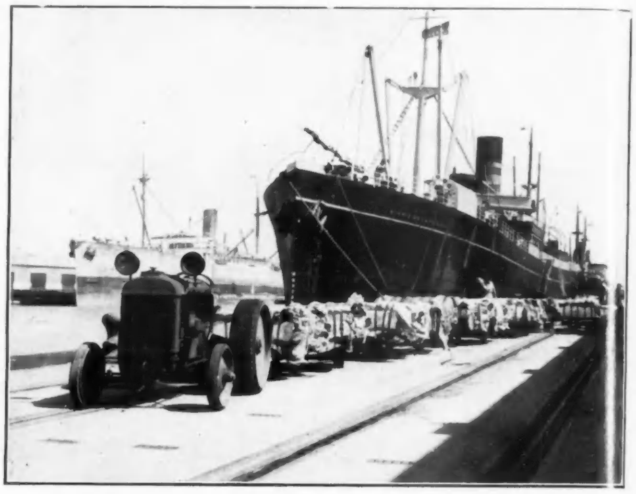
Simultaneously, various new industries and enlargements of existing installations have sprung up in the City. These include huge new plants constructed by the Southern Kraft Corporation, the Aluminium Ore Company of America, the National Gypsum Company and many others. The total investment in industries made in Mobile since the State Docks were formally dedicated exceeds $33,000,000.



Machines used by the Alabama State Docks and Terminals for the expeditious handling of cargo.

As has been notified in this Journal, a Free Port Area or Foreign Zone, after approval of the project by the Legislature, was opened on July 31st, 1938. It did little, however, if any business, and the grant for the installation was revoked on April 14th, 1939.

In the same year, the Legislature passed a reorganisation bill, under which the State Docks became a department of Alabama, succeeding the State Docks Commission, and consisting of a Director, made answerable to the Governor and an Advisory Board composed of three appointees of the Governor, to act, when called upon to do so, in an advisory capacity on any matters coming before or concerning the Department of State Docks and Terminals. Governor Frank Dixon appointed C. E. Sauls, who has held numerous executive and administrative positions with the State Docks, as Director of the terminal system owned and operated by the State. He also appointed as members of the Advisory



Loading Cotton by ship's gear at Alabama State Docks and Terminals.

Board: Robert Gregg, President of the Tennessee Coal, Iron and Railroad Company, Birmingham (Ala.); George H. Lanier, President of the West Point Manufacturing Company, Lanett; and Floyd McGowin, President of the W. T. Smith Lumber Company, Chapman (Ala.).

Shipping and Trade

In 1902, the number of vessels entering Mobile was 905, the net tonnage for all vessels was 604,861 and the tonnage of goods handled was 1,746,219. In 1938, there were 1,414 vessels of a total tonnage of 3,490,439. The value of goods passed through the port in 1902 was $29,565,526 and in 1938, $141,251,000.

Actually the increase in the importance of the port is very much greater than is indicated by the rise in tonnage figures. Exports from Mobile in 1902 consisted largely of lumber, cotton and naval stores. Since then, particularly during the last 10 or 12 years, the number of commodities moving through the port in volume has multiplied many times.

In 1901, Mobile was served by a dozen steamship lines. To-day, ships of 37 lines enter and depart on regular schedule and 32 others have ships making entries at irregular intervals. In addition, the Inland Waterways System operates barge lines between Mobile, Demopolis, Selma, Montgomery, Birmingham, and to Mississippi River points.

The following net tonnage of bulk material was handled through the State Docks during the four fiscal years ended September 30th:

Year	Docks	Plant	Total
1934-5	537,997	217,091	755,088
1935-6	787,498	199,717	987,215
1936-7	1,079,619	416,941	1,496,560
1937-8	1,229,520	265,833	1,495,353

Port Accommodation

Piers with " apron " wharves of reinforced concrete decking on reinforced concrete piling provide a frontage of 11,065 lin. ft. affording sufficient berthage for nineteen steamers of the largest type in use on Gulf waters. To this was being added in 1940, a further length of 1,250-ft., sufficient for three more vessels. (See below).

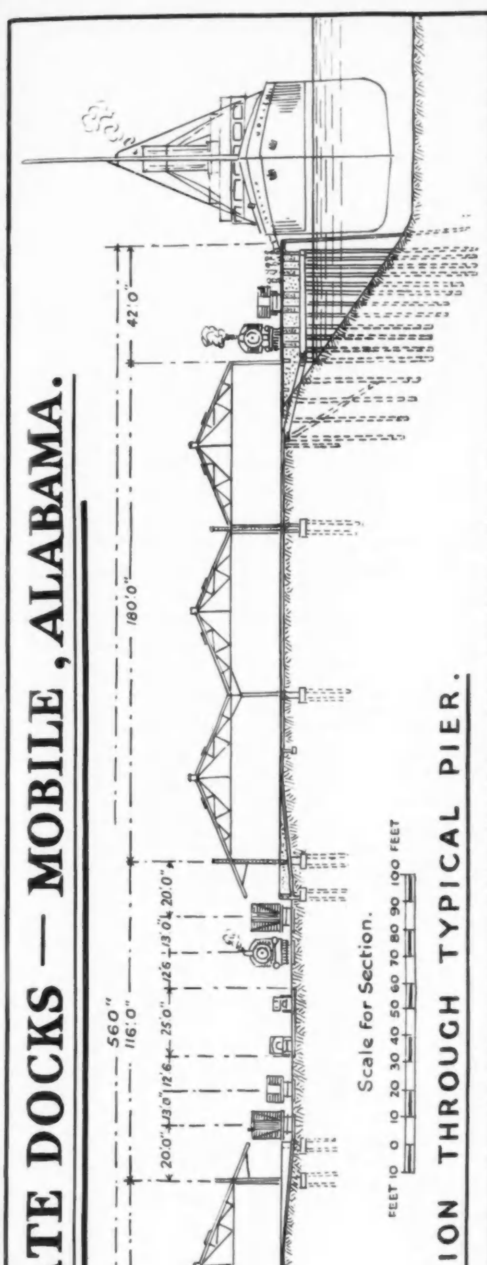
The " slips " or embayments between the piers have a serviceable depth of 30-ft. and a width of 350-ft. This gives ample room for ships to lie on each side of a " slip " with barges alongside and still leave a passageway between for the movement of tugs and other harbour craft.

A typical wharf is 1,600-ft. long, 42-ft. wide with three marginal rail tracks, so located that cars can be switched from one berth to another without interfering with operations at any berth.

Freight warehouses and transit sheds on the piers afford covered and fire-protected storage space of 1,833,696 sq. ft. or approximately 42 acres.

There are five floating docks, the largest of which, 542-ft. by 86-ft., can take vessels up to 12,000 tons deadweight. A new floating dock of 18,000 tons capacity is in course of construction at a cost of $1,450,000. It will be electrically operated.

ALABAMA STATE DOCKS — MOBILE, ALABAMA.



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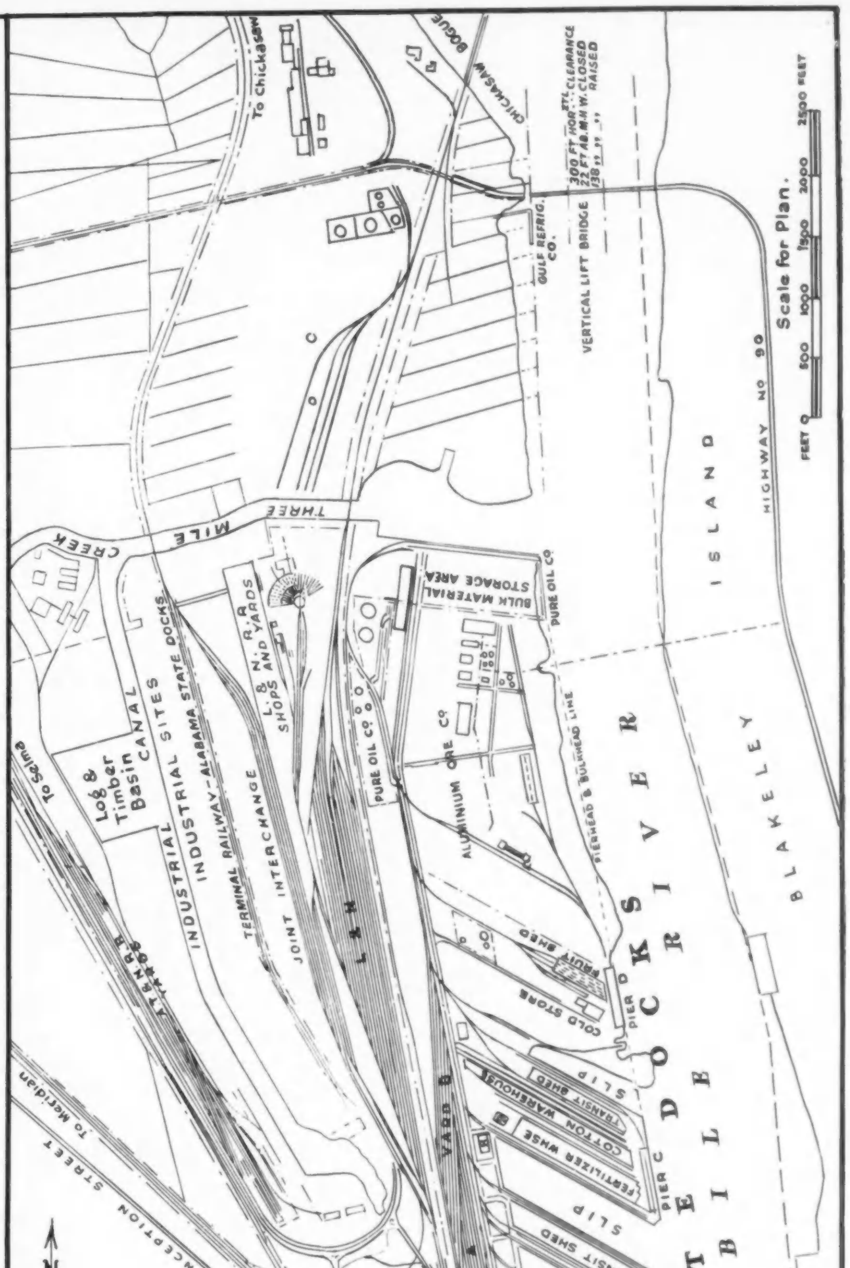
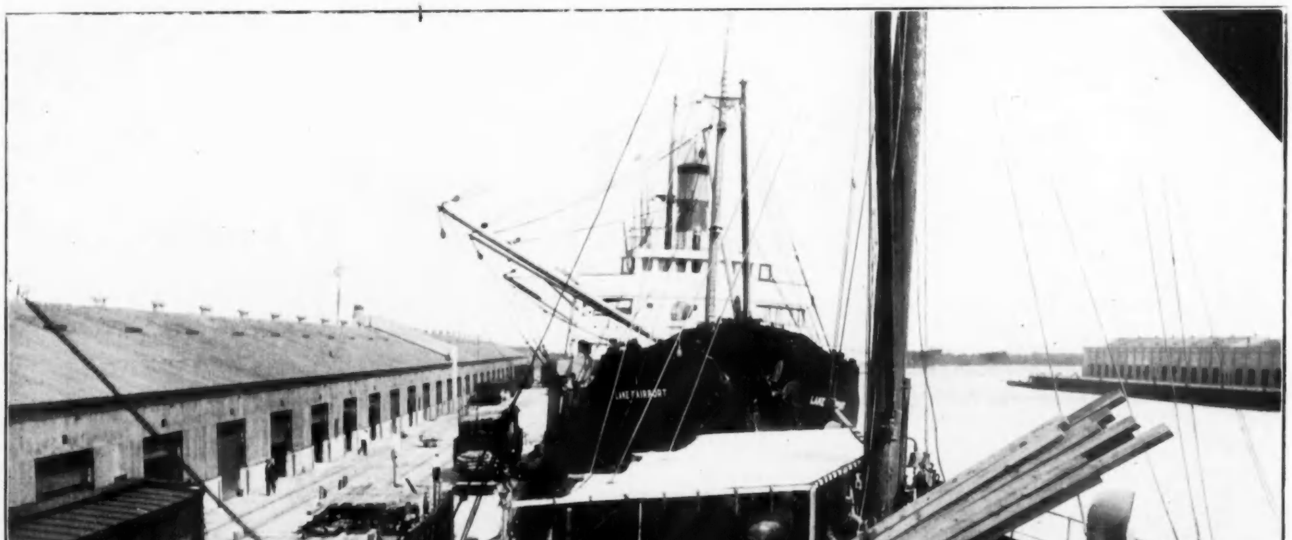


Port of Mobile, Alabama, U.S.A.—*continued*

Aerial View of the Alabama State Docks and Terminals, showing the three main piers, railroad yards and Industrial Canal.



Vessels loading lumber direct from cars on marginal tracks.

Port of Mobile, Alabama, U.S.A.—*continued*

Recent Additions

As already announced in the July issue of this Journal, the growing business of the port has rendered necessary an extension of the berthage accommodation and cargo handling facilities at the State Docks. A new dock, or slip, has been provided diagonally to the Mobile River. On each side there is a reinforced-concrete wharf with transit sheds and warehouses on solid embankment behind, and railway tracks, yards and a roadway in

Canadian newsprint paper in storage in the Alabama State Docks Warehouses.

the rear. The wharf is 1,250-ft. long and its transit shed, 1,000-ft. long by 135-ft. wide. Concrete piles 16-in. square and 45 to 60-ft. in length, are capped by concrete beams, upon which are eight lines of longitudinal girders carrying a deck slab, 50-ft. wide. Three railway tracks have their rails laid in recesses on the slab and secured by clips and nuts on anchor bolts embedded in the girders. Along the rear row of piles is a curtain of creosoted timber sheet piling to retain the upper part of the embankment filling, while under the edge of the wharf is a row of creosoted fender piles. The filling consists of clean sand, which it is more economical to support tnan to build on a pile foundation. The steel frame shed is a single-storey structure with a clear inside width of 120-ft. On the landward side, the steel roof extends 14-ft. to cover an outside platform at floor level and 3-ft. above the rail track alongside. Columns in the front wall are supported on the wharf; those at the centre and in the rear wall, have concrete footings on groups of timber piles. The shed sides are of corrugated steel sheeting on low concrete walls, with numerous openings fitted with steel doors. A complete sprinkler system provides fire protection. As the port is in the Gulf hurricane area, the wharf deck is set 3-ft. above the level of the highest recorded flood and is provided with vents, in case a storm tide should overflow the deck.

Rail Connections

All the wharves, all the units of the State Docks system and all industries located on State Dock property as well as many industries elsewhere, are inter-connected by the Terminal Railway of the Alabama State Docks, and with joint inter-change tracks utilised by five trunk railway lines which enter the port of Mobile and communicate with all parts of the North American Continent. The railroads serving Mobile are the Louisville and Nashville; Mobile and Ohio; Alabama, Tennessee and Northern; Gulf, Mobile and Northern; and the Southern Railway.

Waterway Connections

The Industrial and Navigation Canal extends through the Eastern side of the State's property and through Three Mile Creek to Mobile River, greatly increasing the waterside frontage available for commercial and industrial user. The Inland Waterways include the canalised Tombigbee-Warrior system and the Intra-Coastal Canal connecting Florida with Alabama, Mississippi, Louisiana and Texas points. These waterways are served by steamer and barge lines. The Coal and Bulk Material plant is located at a special basin near the junction of Three Mile Creek with the river. It has a capacity of 600 tons per hour and moves or stores coal, coke, manganese ore, sulphur, bauxite and other bulk material shipped in or out via rail, river barges, trucks or ocean carriers. It is connected by belt conveyor with the Aluminium Ore Company's plant for extracting alumina from bauxite by an electrical process.

Cold Storage Facilities in Port Development*

Advantages and Disadvantages

By GEORGE OSGOOD,
General Manager and Chief Engineer, Port of Tacoma

(*Concluded from page* 211)

Discussion

Mr. Smith Wilson said: I want to compliment Mr. Osgood upon the very efficient manner in which he has covered his subject in his paper. In my opinion, he has unquestionably covered the matter quite thoroughly. Covering both sides of the question in one paper is, I would say, rather hard to accomplish.

He has, however, left a few openings on which I feel able to comment. While he recommends a thorough survey of potential business and a conscience-born certificate of necessity before establishing waterfront cold storage facilities, I wonder if his advice will ever be followed.

Cold storage warehousing is yet decidedly new. It had not passed the stage of refrigeration by ice and salt as late as 1890. Ammonia and calcium chloride brine was first used in that year. Since then we have seen it develop from crude plants of uncertain temperament to the huge, efficient facilities up to 6 to 10 million cubic feet capacity, and so on down to the white porcelain refrigerators of 6 cubic feet capacity in almost every home. And throughout these years the silent, scientific research on cold methods of food preservation has been going on. No one can foretell today what the future holds in plant equipment and methods any more than we could foresee the modern radio and television in the days of the crystal sets. It was only in 1911, the year the Port of Seattle constructed its Spokane Street Cold Storage, that the first laws were passed in some States for the proper control of food in cold storage. Any port, therefore, that contemplates cold storage construction must gamble on business available and must also figure strongly on obsolescence and endeavour to get their money back as soon as possible.

Changes and developments in plant equipment and methods are not the only factors to consider when planning construction. Changes are constantly taking place in the limits of area a plant will serve, in the volume of production in that area, and in requirements for different degrees of temperature because of changing methods of preservation, or because of different types of produce. The Port of Seattle made a survey—they were going to build the plant anyway—but they made a survey and figured the requirement of space which would come from the apple orchards of Eastern Washington. They built a seven-storied concrete cold storage warehouse of 2,000,000 cubic feet capacity and a six-storied concrete cold storage warehouse of 300,000 cubic feet capacity and 85 per cent. of the total was insulated for 32 degrees of temperature. Then what happened to our survey? The Co-ops and others built plants for apples close to the source of production, whcih is a natural development, and the apple business never developed except in a minor capacity. But at Spokane Street there did develop an enormous demand for low temperature space—space for butter, meat, poultry, fish and frozen fruits. It has been a costly experience to insulate and operate a plant built for 32 degrees of temperature and forced to produce zero or lower in most of the rooms. At the smaller plant—and I might say this plant is Bell Street—the space demand developed for mild cured fish and fresh vegetables—commodities requiring temperatures above 32 degrees and 500,000 cubic feet have been added to the plant. In one place we did not have enough cold space and in the other not enough space at 32 degrees, and the development of this business was entirely unforeseen and unexpected back in 1920.

Because cold storage is a new industry and apparently is an attractive investment, its expansion has been tremendous. The investments, though, have been mostly as jumps in the dark. Overbuilding has caused losses in certain areas, and banks wishing to save as much as possible out of the wreckage, have often raised hob with the rates for services. I think this is a cause for low rates in some competitive areas rather than volume of business done, which, without question, does effect the rates possible to obtain for publicly owned ship-side cold storage plants.

I have no wish to appear as opposing the essentiality of municipal waterside cold storage plants, but we should recognise first that waterborne business for cold storage plants has been slower in developing and, in itself, does not yet justify large investments except in particular locations, where the natural flow of commodities needing refrigeration is available. Where waterside plants are constructed without having the natural

* Paper read before the 27th Annual Convention of the Pacific Coast Association of Port Authorities, September, 1940.

Cold Storage Facilities in Port Development—continued

advantage of these necessary commodities, we must look elsewhere then for business, and in so doing we come into competition with privately owned plants off the waterfront.

For a number of reasons the tendency of late years is to build more small plants close to the sources of production rather than a few large plants, each serving a wide area. When the Spokane Street cold storage was built, it received goods for warehousing from points 200 or more miles from Seattle. Since then, thanks to the co-ops, and to others, 80 per cent. of our business, with the exception of fish, originates within 30 miles of Seattle. And this, I believe, will be about the limit within which future warehouses can look for business. I would be interested to hear of the experiences of San Francisco in this respect.

There is no question but that the waterside cold storage facilities of the Port of Seattle have been very essential and of great material benefit to the producers and shippers in our area. The co-operation we gave to producers and to the United States Frozen Pack Laboratory was of great assistance in the development of the cold process in freezing fruits and vegetables. More than 25,000 distinct experiments in freezing kinds and varieties of fruit and vegetables under various conditions have taken place in the terminal cold storage, and at nominal cost to the laboratory. It has resulted in saving millions of dollars, and has kept thousands of small farmers from bankruptcy.

Fishing Icing and Storage

Mr. Osgood, in his paper, has mentioned my name as being thoroughly familiar with the quick freezing and storage of fish. This operation at our Spokane Street terminal has been a big help in making Seattle one of the largest fresh fish markets in the States. Many of the methods of glazing fish, of packing, and icing cars and boats now in common use originated at our Spokane Street fish plant, which, in recent years we have been forced to enlarge, particularly one quick freezing plant, to take care of the business offered.

If I may add this: Four years ago it was necessary to double the sharp freezers for the freezing of fresh fish, principally halibut and salmon, and since that time we have eight freezers. In season, those eight freezers have been busy practically continuously—just one continuous flow through them.

Also, I would like to mention at this time the advantage we have had in the production of zero ice for the use of fishing boats. This has proved quite an attraction for fishermen, and has been a remunerative service that we have performed for them.

Now, I would like to enlarge just a little on that. When these boats go out to the fishing banks, they always take a supply of cracked ice; ice as it comes from the tanks is not as chilled and as cold, in other words, as it can be made by putting it into a sharp freezer room and still chilling it down farther, and we have now built rooms for the purpose of chilling that ice on down farther and when it goes through the crusher, it breaks up and is very flinty and hard. This ice goes out to the banks, they pack the fish in it, and it still has much more refrigeration in it than it originally had when it was freshly pulled from the tanks and the fishermen like it particularly because it does not melt and freeze back together and is much easier for them to use for bringing back their catches.

The quick freezing of fish has gone through the same stages of experimentation that other food cold processing has experienced. I particularly point out that our fish business is a natural resource of our particular geographic location, which I referred to formerly as being a requisite for the building of waterside cold storage plants.

Refrigerated vessels come to the north-west for fruit and they get it at tidewater without much use of cold storage. But to them and to shippers alike the waterside cold storage plant is an insurance against loss and/or expense in emergencies. Without doubt, this has been a drawing card to the port for both steamship service and for the fruit export trade.

But the waterside cold storage in Seattle was built at a very opportune time. There was a scarcity of cold storage space, many uses for cold storage that have since developed were unknown, and because it is a part of our job we have been able to assist very materially during the pioneering. Finally, the plant been a good investment. Whether or not these fortunate circumstances will prevail at any port now is problematical.

Regarding Mr. Osgood's remarks on efficient plant construction, I would add the advantages of having a major portion of the warehouse insulated and piped for low temperatures. This, of course, would depend on the nature of the production in the area to be served. But even then, the uses to which the plant may be put cannot be foreseen, and it is cheaper to prepare at first than to remodel afterwards. I think Mr. Osgood's suggestion for intended loading platforms is an unnecessary waste of space and can be eliminated as far as efficiency is concerned, unless there is plenty of room.

Where there are large islands adjacent to the port such as exist in Puget Sound, or where producing areas are reached quicker and more economically by transportation by water, it is a big advantage to the grower to have waterside cold storage facilities. The advantage of waterside cold storage for overseas import business is, of course, obvious. It means transfer from ship to cold storage without great cost and without dangerous delay in high temperatures. But this business is uncertain. We formerly received large quantities of nuts from the Orient, but the traffic has been diverted, and now practically all of this business is for purely local consumption. The local area in this instance may extend inland to a common point where rates are on a parity with another port equipped with waterside cold storage.

With fish, the advantages are all on the side of tidewater facilities. In fact, none of the uptown plants in Seattle compete for this business unless they are located adjacent to the waterfront.

One big advantage that waterside cold storages have is the availability of all forms of transportation—water, rail or truck—to offset this, however, is location. A centrally located plant can draw business from four sides, but a tidewater plant, unless it is fed from adjacent islands, is on a stub end, as it were. Distribution from a waterside warehouse is likewise usually subject to longer truck haul to consumers place of business.

After all, when this response is summarised, I have added little to Mr. Osgood's remarks due to the very efficient manner in which he has covered the subject, thus leaving me little opening for disagreement.

Colonel B. C. Allin said: Mr. Osgood has presented a complete and yet brief article covering the subject of cold storage plants and properly, under the circumstances, held to consideration of this subject from the standpoint of the Pacific Coast.

There is only one pertinent thought which occurs to me as proper of development, based on Mr. Osgood's paper, and that is the probability of development of a proper waterborne commerce in refrigerated products, particularly in the intercoastal trade.

Omitting consideration of the matter of frozen fish, which would seem to belong in Mr. Smith Wilson's territory, we come largely to the matter of cold storage of fresh fruits.

Conditions have changed very rapidly since the opening of the Panama Canal, and our intercoastal service has grown from small proportions to one of considerable magnitude as a factor in Pacific port operations. It has been significant, however, that even though this trade has grown so tremendously, still the handling of refrigerated products in it has practically remained stationary.

This is probably due to two reasons. First, the railroads have a tremendous quantity of special refrigerator car equipment and icing plants, designed solely for the purpose of handing west coast fresh fruits and food products to the east, and it stands to reason that they are very loath to lose this business, and will undoubtedly exert every effort to prevent this type of business being taken from them by water carriers.

In all other types of intercoastal traffic, the water lines have obtained a healthy share, but in this one class of business very little has been developed.

The other reason probably lies in the fact that refrigerated equipment not only is costly to install in a vessel, but also quite often results in the size of hatches and other details of the ship being so altered that the cost of handling of general commodity freight in the refrigerator compartments, when refrigerated cargo is not available, becomes costly and burdensome, and thus becomes an actual detriment to the efficient operation of the vessel for purposes other than refrigerated freight.

In this connection it should be borne in mind that the United Fruit Company, for example, have a very fine fleet of refrigerated vessels which are used primarily in the banana trade. Unquestionably, the United Fruit Company could develop a very attractive intercoastal refrigerator business if it were of a mind to do so. However, it must be remembered that United Fruit Company primarily is in the banana business, and accordingly, is dependent upon the railroads for the prompt and efficient handling of refrigerated bananas from numerous coastal ports to interior points, and it may reasonably be expected that for this reason the United Fruit Company will consider a long time before they will undertake to develop an intercoastal refrigerator business, thus attacking the last stronghold of the transcontinental lines, when they are dependent upon these very same people for the economical and proper handling of their own major business.

Consideration has been given a number of times to the construction of refrigerator vessels for the intercoastal trade, but up to the present time this has not materialised, and there seems no probability of this developing at the moment. However, it is entirely practicable, and certain cargoes have been handled as an experiment to determine whether the intercoastal handling of fresh fruits can compare favourably with rail shipments from the standpoint of the out-turn in the east. Only a few years ago, trial cargoes were arranged by chartered vessel, and it is understood that the out-turn at New York showed the fruit to be in a definitely superior condition—better than that usually encoun-

(Concluded on page 238).

Notes of the Month

New Pier in Puget Sound.

A contract in the amount of $1,278,000 has been let for the construction of a reinforced concrete pier, 730-ft. long by 90-ft. wide at Bremerton, Washington, U.S.A. The work is being done for the Bureau of Yards and Dock, U.S. Navy Department.

Resignation of Port Regional Shipping Representative.

On grounds of a disagreement in policy, Sir William Reardon-Smith has resigned his post under the Ministry of War Transport as Regional Shipping Representative for the Bristol Channel Area to which he was appointed in March last.

Port Enquiry Committees.

In reply to a question in the House of Commons, the Parliamentary Secretary to the Ministry of War Transport said that an enquiry was being held into the operation of dock decasualisation schemes at one group of ports and that constant touch was maintained with its operation at other ports.

Increase in Port Rates at Liverpool.

Increases have been made in the rates and dues of the Mersey Docks and Harbour Board. Dock tonnage and wharf rates on vessels and dock rates and town dues on goods have been raised by 60 per cent., while a reduction of 20 per cent. which had been allowed in harbour rates on vessels, has been discontinued and an increase of 15 per cent. imposed.

Dockside Thefts.

In connection with a criminal charge at Hull, it was stated that hundreds of pounds worth of goods had been stolen at Hull Docks by a cunning subterfuge, the procedure being to drop a bale, or case, into some quiet part of a ship, where the goods were afterwards divided up. A bale of 300 pairs of socks valued at £75 had been treated in this way.

Federation of London Public Wharfingers.

There has recently been formed and registered as a limited company, the Federation of London Public Wharfingers. The objects of the federation are stated to be: " To watch over and protect the general interests of persons, firms or bodies engaged on, or interested in, the businesses of wharfingers, warehousemen, shipping agents, storage contractors, dock and wharf owners carrying on business in or through the Port of London."

New Ship Channel to Lake Charles.

There has recently been completed a new and direct ship channel from the Gulf of Mexico to the port of Lake Charles, Louisiana, U.S.A. Formerly the water route via the Calcasieu River, Intracoastal Canal and Sabine River for a distance of 75 miles. The new channel reduces this to about 35 miles. It has a minimum depth of 30-ft. and a minimum bottom width of 250-ft.

Rotterdam Port Reconstruction.

It is announced in *Schiffbau* that plans have been prepared for the reconstruction and modernisation after the war of the Port of Rotterdam, which has suffered very severely from aerial attack both from German and Allied sources. Among other items in the programme of works, new cold storage plant will be installed, particularly for rapid refrigeration. Two large oil-seed elevators, with an hourly capacity of 500 tons are already in course of construction.

War Compensation in the Pilotage Service.

It is announced in *The Pilot*, the official organ of the United Kingdom Pilots' Association that a ruling has been given by the Ministry of War Transport and the Ministry of Pensions on compensation to pilots for war injuries and detention. It has been laid down that the scheme was only intended to apply to pilots when their duties take them to sea and that, therefore, when a pilot is employed on a vessel otherwise than for the purpose of taking her or assisting to take her in or out of port in the British Islands, he will not come under the scheme.

Malmö Free Port Report.

The report of the directors of the Malmö Free Port Company for the year 1940, submitted to the annual meeting, shows that at the beginning of the year all quay storage and warehouse space was occupied, but when sea communications with the West were interrupted (owing to the German occupation of Denmark and Norway) traffic fell to only small dimensions. Thus, during 1940, 181 vessels, of about 249,000 tons net, arrived at the port, compared with 294 vessels, of about 590,000 tons, in 1939. The cargo discharged and shipped totalled about 196,000 tons in 1940, compared with about 210,500 tons in 1939. The accounts show a surplus of about 223,000k., against 433,900k. in 1939.

New Wharf at Saint John, N.B.

The construction on the West side of Saint John Harbour, New Brunswick, has been authorised of a timber wharf 900-ft. in length to cost approximately $500,000. The work is expected to be completed in time for the coming winter shipping season.

Fraserburgh Harbour Repairs.

At a recent meeting of the Fraserburgh Harbour Commissioners it was reported by the harbour engineer that an expenditure of £22,200 on repairs was necessary. As no funds were available, it was decided to make an application to the Fishery Board for Scotland for financial help.

Isolation Hospital for the Port of Calcutta.

The Bengal Chamber of Commerce have received an intimation from the Port Medical Officer that the question of providing an isolation hospital for the Port of Calcutta has been under consideration by the Public Health Commissioner of the Government of India whose decision on the matter is awaited.

New Harbour at Luanda.

The announcement is made that a contract has been entered into by the Portuguese authorities with an Anglo-Dutch company for the construction of a new harbour at Luanda in Portuguese West Africa. Details of the design are not available but the work is estimated to take three-and-a-half years to complete at a cost of nearly half-a-million sterling.

First Australian Floating Dock.

The first floating dock to be constructed in an Australian shipyard was recently launched in Queensland. The ceremony was attended by Mr. Forde, deputy leader of the Federal Labour Party who in a subsequent luncheon toast paid a tribute to the capability and skill of Australian shipwrights. Dimensions of the dock are not to hand.

Port of Cochin Annual Report.

The Annual Report of the Administration of the Port of Cochin, Wellington Island, Southern India, for the year ended 31st March last, shows that the tonnage of imports and exports during the year was 951,363—this was not only greater by 165,234 tons than the total for the previous year, but was the highest figure ever recorded. The number of vessels visiting the port was 622 steamers, with a tonnage of 1,732,452, and 532 sailing vessels with a tonnage of 30,374.

Port of Bombay Finances.

At the last reported meeting of the Bombay Port Trust the preliminary working results of the year ended 31st March, 1941, were recorded. The actual receipts on General Account amounted to 265.46 lakhs of rupees or an increase of about 23 lakhs on the actuals of 1939-40. The improvement has mainly taken place in receipts from Wet and Dry Docks, Lands and Buildings and the Railway. The working result of the year is a surplus of about 35 lakhs.

Port of London Conversion Stock.

The Port of London Authority have given notice that their 4¾ per cent. stock 1940-60, of which some £2,600,000 is outstanding, will be redeemed on 1st February, 1942. At the same time, holders are invited to convert into new 3½ per cent. stock repayable in 1965, but redeemable any year after 1960 at the option of the Authority. This new stock is issued at a price of 99, so that holders of the 4¾ per cent. stock who convert will receive a cash bonus of 1 per cent.

Proposed Houston Ship Channel Improvement.

Under the direction of the United States Corps of Engineers, a survey is being made of the Houston Ship Channel, Texas, with a view to deciding whether the project for widening and straightening the channel should be expanded. Local interest desire an increase in bottom width from 400 to 600-ft. across Galveston Bay, and intermediate increases terminating in a bottom width of 300-ft. at the Turning Basin, together with the easing of sharp bends in the channel.

Foreign Trade at the Port of New York.

Export traffic through the Port of New York in 1940 was valued at nearly two billion dollars, the largest in any year since 1920. Nearly half this commerce was shipped to Europe, principally Great Britain. Shipments to Europe, and Central America increased $95,000,000 over 1939, while Africa and Asia respectively gained about $40,000,000. A decline in imports from Europe was offset by an increase of $140,000,000 in shipments from Asia. Imports from Africa also showed a large gain. Total imports through the Port of New York increased by $90,000,000 over those of 1939.

Port Labour Organisation

Issue of Essential Work (Dock Labour) Order by Ministry of Labour and National Service

The following memorandum has been issued by the Ministry of Labour and National Service in connection with the promulgation of an Essential Work Order for Dock Labour:

The Minister of Labour and National Service and the Minister of War Transport recently asked the National Joint Council for Dock Labour to submit proposals designed to secure to the port transport industry by the application of an Essential Work Order a regular, sufficient, and mobile labour force. The Council subsequently reported to the Ministers that they had reached agreement on new conditions of employment to operate at selected ports, and that they would set up a company to finance and administer port schemes, embodying the new conditions.

On the basis of these proposals, and in full consultation with the representatives of the industry, there has been prepared an Essential Work (Dock Labour) Order and a model scheme which would meet the requirements of the Minister of Labour and National Service under the Order. The provisions of the Order and the new terms of employment agreed by the National Joint Council do not apply in a port unless and until a scheme for that port has been approved by the Minister and is in operation.

Formation of National Dock Labour Corporation

The principal features of the arrangements are as follows:—

The National Joint Council is forming a company, to be known as the National Dock Labour Corporation, Ltd., whose duty it will be to promote, finance, and administer schemes. The Corporation will also be responsible for transfer of dockers from one port to another. The Board of Directors of the Corporation will include a chairman, appointed by the Minister after consultation with the National Joint Council, a Finance Member appointed by the Minister, and three representatives of employers and three representatives of workers appointed by the National Joint Council.

There will be a Local Board and a Port Labour Manager appointed by the Corporation. The Local Boards will be responsible to the Corporation for matters of local policy and general administration, and will co-operate with the Regional Port Directors and Port Emergency Committees in providing the labour required for the quick turn-round of ships. The Port Registration Committees will continue to register port transport workers and employers, and will have certain new functions under the schemes, but they will no longer control the arrangements for engaging labour. The Local Joint Committees will continue to be responsible for industrial negotiations.

Terms of Employment

Though the Order will apply to permanent men, their employment will not be affected by the new arrangements. Other dockers selected for inclusion in the scheme will now always be in employment. While employed in port transport work or other work for which the scheme provides, the docker will be paid the appropriate rate for the job. Piece rates are to be introduced as widely as possible. As soon as his job finishes the docker will come automatically into the employment of the Corporation, and, so long as he fulfils the conditions, he will be paid 5s. for each of the eleven half-days (normally Monday to Saturday noon, inclusive) on which he reports as required but is not allocated to work. Special provision will be made for aged and light-work men, who cannot be expected to do a full week's manual work. It is a condition of the docker's employment under the scheme that he should not only report regularly as required, but be prepared to take any suitable work offered, including any work necessary for the clearance of the port area, and travel to other ports as may be necessary.

Failure to carry out the conditions involves loss of any payments otherwise due from the Corporation for the week in which the failure occurs, and may be followed by disciplinary action including, in extreme cases, exclusion from the scheme. Appeal Panels will be appointed within the industry to decide appeals arising from the disciplinary action taken by the management.

Regular workers will be eligible for an annual week's holiday for which they will be paid by the Corporation 80s. or 75s. according to the size of the port.

All wages due whether from employers for whom men have worked, or from the corporation, will be paid weekly by the manager, who will also stamp the men's insurance cards.

Except in cases of dismissal for serious misconduct, seven days' notice must be given before a docker can leave or be discharged from the scheme. If objection is raised, and also where an appeal is made against dismissal for serious misconduct, the case is to be referred to the Appeal Panel whose decision if unanimous is final and may be supported by a direction of the National Service officer. If the Panel is not unanimous, the case is to be referred to the National Service officer for decision.

Duties of Employers

Only registered employers will be entitled to engage in port transport work, and they will only be allowed to employ on such work their own permanent men or men allocated to them by the manager. They must give due notice of their labour requirements, keep records and pay to the manager each week the wages earned by men allocated to them together with the prescribed contributions to the National Management Fund. An employer who fails to comply with the requirements of a scheme may be removed from the register, subject to an appeal to the Minister.

The cost of all schemes will be met from a National Management Fund maintained by the Corporation. Employers under approved schemes will be required to make a contribution to the fund which will not, under present arrangements, exceed 25 per cent. of their gross wages bill. The fund will be underwritten by the Exchequer, which will, in addition, make a contribution in respect of certain administrative expenses of the Corporation.

The preparation of schemes covering the Port of London and the principal ports on the Bristol Channel, Firth of Forth, Humber, Tees, Tyne and Wear will commence immediately the Corporation has been formed and the Order made. The Order will not be applied to the Merseyside and Clydeside ports (where the Minister of War Transport is now the employer of all dock workers) without further consideration.

Minister's Statement

At a Press Conference meeting held in London on August 14th, Mr. Ernest Bevin, Minister of Labour and National Service, made an amplifying statement on the new scheme, reported as follows:

The purpose of the scheme, Mr. Bevin said, was to ensure that for the duration of the war, an adequate number of dockers should be kept at the ports in order to deal with the shipping industry. At the present time, under casual conditions, there was nothing to retain them, and it was extremely vital that the men—who were competent and skilled—should be at the ports in order to handle the shipping as speedily as possible and so ensure an efficient turn-round.

To do that, it had been decided not to follow the Liverpool Scheme, because the conditions were somewhat different, and the Essential Work (Dock Labour) Order was a completely negotiated settlement between the unions and the employers, as well as the State. The new scheme provided that the men would be permanently employed; while so employed in the scheme, if there was no work they would be paid 5s. for each half-day, Monday morning to Saturday noon, Saturday afternoon and Sunday had been excluded and would be treated separately at the ordinary pay ruling for that day if the men had to be called out. The men were expected under the scheme to present themselves for work unless kept away by illness or other sufficiently good reasons. If the men failed to report and neglected their duties they lost the attendance money. A new feature introduced into the scheme was holidays with pay. The men would be guaranteed a week's holiday each year and would be paid 80s. for that week in the case of the large ports and 75s. in the case of the smaller ports.

For the time being, the present system of payment daily would be continued, but socially that was a bad thing, and under the new scheme a weekly payment of wages would be introduced. It was intended, as far as possible, to make the weekly payment on Thursdays, so that the womenfolk would have a chance of shopping equal with other people. The scheme also provided for the right of appeal, either in the case of a man denied attendance money if he thought he had a valid reason to put forward, or if he had been subjected to disciplinary action or suspended. Both unions and employers would be represented on the appeal committee.

One of the main difficulties in the scheme had been to find someone to administer it. A State Department did not provide the answer, for there had to be a flexible arrangement which allowed for adaptation in the different ports. Therefore they were in process of forming a national corporation called the National Dock Labour Corporation, Ltd. The men would be employed by their ordinary employer in so far as he had work, but the corporation would be responsible for dealing with the men when not so employed and arranging for their transference to other employers or other ports.

The corporation was non-profit-making. It was virtually a State company. The Minister of Labour would be responsible for the appointment of the chairman and of the finance director. The other members of the board would be drawn from the unions and the employers through the National Joint Council. The scheme would be underwritten by the Government, but its cost would be met by a levy of 25 per cent. on labour charges at the ports. The corporation would thus have an inducement so to organise the labour supply and make it efficient that the industry could reap an advantage if the cost was kept down.

The scheme was a new and a somewhat novel development, Mr. Bevin concluded, but its purport was hopeful. It would not only serve the war purpose, but was so devised that it had all the elements to cover the question of permanency and to deal with the vexed problem of decasualisation.

Ship Salvage in Harbours and Docks

A Difficult and Hazardous Operation

By "NORTHFLEET."

(*Concluded from page 208*)

Fig. 7. Floating a Wreck (decks awash), by Camels on a calm day.

The Use of Camels

Next the writer will discuss the lifting of submerged vessels by direct lifting camels, and may, at the same time, compare the weights moved by tackles and those by submerged lifting craft such as camels. (Fig. 7). In using purchases to upright the *Segovia* the total weight to be overcome was 1,240 tons, which, it may be concluded, allows for the immersion which makes a solid object lighter in water.

Within recent years there have been two examples of direct lifting operations—one a vessel the writer will name *Isinglass* and the other the submarine *Thetis*.

The former was raised in a tidal harbour in approximately 45 feet at L.W.O.S.T., with a mean range of 18 feet; the other, as is well known, was in much deeper water in Liverpool Bay with a spring time range of 31 feet. When calculating the raising of such wrecks, it is necessary to debit, as an offset to the buoyancy derived from immersion in water, the final stage when the ship, or a large portion of it, comes into the atmosphere and the buoyancy from the deep immersion disappears.

The Salvage of the Isinglass

The *Isinglass* was a three-compartment collier, having a cargo of 2,400 tons of coal in her two holds, which were divided by a wooden partition when she was cut down at moorings. The impact was so severe that the bows of the colliding vessel virtually sheared away 25 feet of the collier's hull abaft No. 2 hold. In dimensions, the *Isinglass* measured 240 ft. between perpendiculars x 37 ft. breadth moulded x 19 ft. 9 in. depth moulded. Her builder's weight of metal, including engines and boilers, was 962 tons. There would be about 60 tons of bunkers and equipment, making a total of 1,022 tons, which added to the cargo was 3,422 tons weight in the atmosphere. For the primary lifts when fully submerged, the weights would be reduced to about 1,450 tons, with about 300 tons added as a conservative estimate for the friction or drag set up by the broken tail-end of the ship, which was never lifted quite clear of the clay bottom. Thus a total of some 1,750 tons formed the early lifts.

Owing to the silt in suspension and the awkward lie of the wreck, under-water cutting of the broken tail-end away was set aside and the diver's information was not such that reliance could be placed on making a clean job with explosives to avoid further damage to the vessel, which would contribute to a constructive total loss.

As a result of the policy of direct lifting and heaving on to high ground, the cost of raising fell within 25% of the value of the sound ship, regardless of cargo. The wreck lay on her starboard beam ends across the channel, and therefore across the line of the tidal streams which had a mean velocity of 3 knots at mid-depth during the half flood and half ebb periods. The period of slack water was short, and was about 20 minutes at low water and at high water. Over the hull the depth at L.W.O.S.T. was about 8 feet. Masts and funnel, davits and boats were removed and messenger wires passed which were used to reeve the heavy lifting wires. These were placed at suitable intervals, and consisted of 6 pairs with the two after pairs where the stream would be heavier, having double bottom wires or strops, thus :—

From No. 1 pair.—14 fathoms of 7in. double strop with one tail of 8in. 15 fathoms in length.
,, No. 2 pair.—14 fathoms of 7in. double strop with one tail of 8in. 15 fathoms in length.
,, No. 3 pair.—12 fathoms of one 9in. with one tail of 8in. 15 fathoms in length.
,, No. 4 pair.—50 fathoms of one 9in.
,, No. 5 pair.—50 fathoms of one 9in.
,, No. 6 pair.—50 fathoms of one 9in.

Ship Salvage in Harbours and Docks—*continued*

These wires were passed over the decks of the lifting craft on the crossed shoe-lace principle, viz.:—

No. 1 pair—(a) up over starboard side
(b) up over port side } married by clamps to each other, or lashed with chain seizings with a reverse pull.

No. 2 pair—As for No. 1, etc.

There were six lighters, three each side, taking two pairs of wires each. The theoretical breaking strain at 90 tons per square inch on the surface wires amounted to approximately 2,300 tons, not allowing for chafeage and nip, and the practical breaking strain would be about 2,000 tons. As none of these wires parted, it must be assumed that the load did not reach the tensile stress of a breaking strain. A careful hydrographic survey was made of the slope of the adjacent bank to bring into leverage the gradient for righting the vessel when lifted. Three measures were decided upon:—

(a) To lift and place the wreck on beam ends with the decks facing inshore for the purpose of uprighting on landwara slope.

(b) To upright by parbuckling wires.

(c) To lift in the upright position and beach with head inshore and beach on an even keel for removal of cargo and for pumping out.

In the lifting operations which followed, and which were generally confined to spring tides, three lifts were essential for (a) owing to the stretching of the wires.

At the first lift the flood tide carried the bows upstream due to the fore end rising earlier than the damaged stern.

(b) As the coal cargo lay on the starboard side, this altered position of the centre of gravity was used to upright the vessel—by placing the wreck starboard side to the high level of the river bank. This entailed a complete turn in the tideway of 180° to align the starboard side with the contours of the river bed. To ensure the security of the hull during parbuckling operations special moorings were laid out. Parbuckling was organised on a combination of tidal pressure and tackles, and the coal cargo, by its immersed light weight, rolled over in the ship assisting the vessel to come to the vertical once the righting movement commenced.

(c) Operations were assisted by a springtide low water, which brought the fore end of the ship dry when beached. Hatch boards were used to raise the fore hatch coamings, ventilators and other apertures were closed and pumping out No. 1 hold undertaken.

The actual programme was as follows:—

22nd December.—Vessel sunk. 9th January.—Removal of masts, funnels, davits, boats, ventilators and reeving wires (18 days' work). 19th January.—Commenced lifting operation, uprighted by parbuckles (10 days' work). 28th January.—Vessel refloated (5 week's operations).

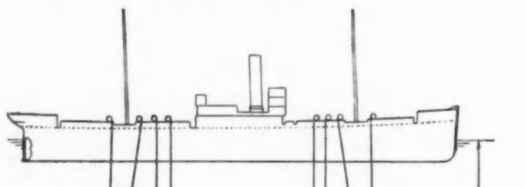


Fig. 8. Raising the Submarine "Thetis."

Salvage of Submarine "Thetis."

The writer has now surveyed the several methods of salvage practice in harbours from actual operations, but the raising of H.M. Submarine *Thetis* in Liverpool Bay deserves a place in the category, although sunk outside the confines of a seaport. Sunk in 25 fathoms with a mean range of approximately 22 feet and a surface velocity reaching 4 knots. A period of slack water of about 30 minutes. The minimum depth produced a pressure of 67 lb. to the square inch, rendering sustained manual effort by divers negligible.

Owing to the exposed position of the wreck, 15 miles from Great Ormes Head and a similar distance from Liverpool Bay Lightship, the problem of caring for several lifting craft and crews in bad weather was a serious one, and the officers of the Liverpool and Glasgow Salvage Association, who were the salvors, wisely decided to adapt a sea-going ship of suitable dimensions for the raising operations. The relative dimensions were:—

s.s. *Zelo*—Lifting vessel 308 ft. by 43 ft.
H.M.S. *Thetis*—wreck—275 ft. by 26 ft. 6 ins.

The dead weight carrying capacity of *Zelo* was 3,350 tons with bunkers full.

The submerged weight of *Thetis* was 1,000 tons approximately.

The *Zelo's* ballast capacity was 1,030 tons.

Eight slings were used, consisting of 9in. wire with a nominal breaking strain of 240 tons, but the wires were subjected to a special breaking test of 265 tons before acceptance.

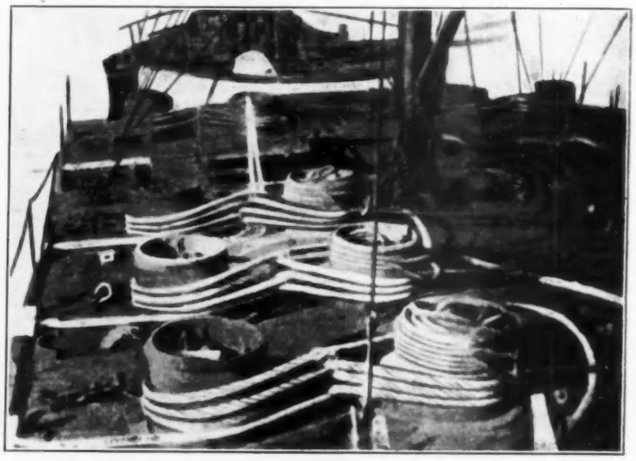


Fig. 9. Raising Submarine "Thetis," arrangement of bollards for securing lifting wires on ss. "Zelo."

During the operations the plan of adapting the *Zelo* for wreck lifting operations was supervised by Dr. A. M. Robb, a naval architect working in co-operation with Sir Stanley Goodall, Director of Naval Construction. Arrangements were first made to fit 8 athwartship beams projecting over the side of the *Zelo* (Fig. 8), each beam consisting of four pitch pine logs bound together. On this principle, the 9in. wires were wrapped around the beam ends and secured for lifting.

Owing to the failure of the beams to stand the stresses, steel girders were later used, with built-in bollards of special strength. These are shown in Fig. 9, and were found suitable. A completed bollard was tested to 180 tons. The operations were resumed on the 24th August and on the 28th of that month a lift was made which was successful. This was followed by a series of tidal lifts which were nine in number, at which stage the upper works were awash at low water. The wreck was then too close to the *Zelo's* bottom for further lifts and compressed air was used to refloat the Submarine from that position. Thus by 1st September the wreck was safe, re-floating by compressed air. Diving parties from H.M.S. *Tedworth* (Lieut. Commander W. J. Stride, R.N.) were in constant attendance throughout the operations. Many difficulties had to be overcome in the compressed air stage of the salvage operations and on the 18th November the submarine was docked at Birkenhead, four months after the commencement of the first designed operations. The delays and anxieties caused by heavy swell and disappointing tides, have not been stressed for the sake of brevity of exposition, but reference should be made to the skill and patience of the Officers concerned with the raising of the *Thetis* when so much depended on refloating the Submarine to the surface, for evidence on the cause of foundering, which had become a national question.

Raising of the Vindictive

The successful salvage of H.M.S. *Vindictive* at Ostend in August, 1920 (Fig. 10) constitutes a record in tidal lifting in harbours. In this case Commodore Sir F. W. Young, R.N.R., lifted 6,200 tons, using compressed air, together with pumps and lifting camels. His work extended the raising of the block ships *Iphigenia* and *Intrepid* and *Thetis* on a coast where the rise and fall of tide did not give the lifting range which was of such service in the raising of the submarine *Thetis* in Liverpool Bay.

Compressed Air Achievements

Of compressed air achievements, in the writer's opinion there is nothing to compare with the unwearying efforts made during the years 1925 to 1935 for the raising of the sunken German warships at Scapa Flow. Bottom upwards, sometimes in water of considerable depth for diving work, the problems faced and overcome were unique. That the work was one of commercial enterprise and financial risk is the more meritorious and still more important in view of the use of Scapa in this present war. The vessels in question, which exceeded 20,000 tons displacement in the general run of the operations, were raised bottom up and floated several hundreds of miles to dry dock on a cushion of compressed air, under towage to the shipbreakers. The opera-

Ship Salvage in Harbours and Docks—continued

tions consumed much time in view of the preparative details and preliminaries essential to the work. The principal warships thus raised were:

Moltke, 23,000 tons, bottom up in 13 pieces.
Seydlitz, battle cruiser, lay on starboard side in 11 pieces.
Kaiser, 25,000 tons, bottom up in 13 pieces.
Vonder Tann, 19,500 tons, bottom up in 15 pieces.

In order of convenience for wreck raising, the vessels which respond to the use of compressed air by their design are the

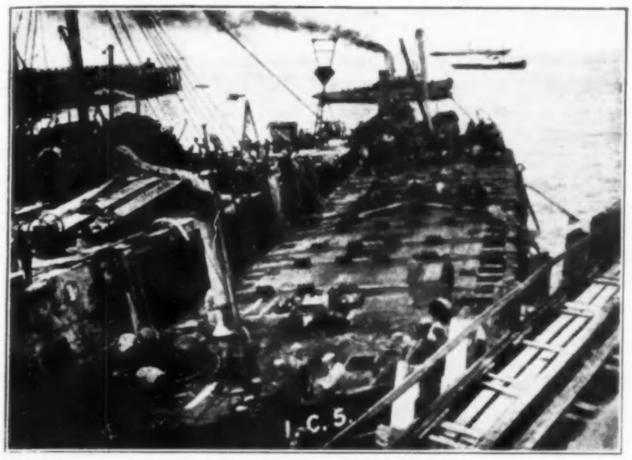


Fig. 10. Salvage of H.M.S. "Vindictive" at Ostend, August, 1920.

tanker and the warship. Merchant vessels are not so designed and require much preparation for the application of compressed air. As with the use of compressed air, a discovery of the civil engineer adapted by salvage experts for the raising of wrecks, so is the salvor indebted to the mechanical engineer for many inventions now available and which facilitate the raising and removal of sunken and stranded vessels from docks and tidal rivers. Among these may be mentioned:—

(1) The self-priming centrifugal pump, whether driven by an internal combustion petrol engine or diesel engine.
(2) The under-water metal-cutting appliances, now used by divers.
(3) A submerged bolt-driving and punching gun which drives a projectile in the form of a bolt into ships' plating to assist under-water patching.
(4) Carbon arc welding.
(5) Oxy-acetylene cutting and welding.
(6) Electric arc welding.
(7) The Echo-Sounder.
(8) The hack saw.

The submersible centrifugal pump continues to improve and do great execution when there are engineers and fitters to look after its submersible parts, which are so easily damaged by chemical action. In the salvage of ships in dock there is nothing so variable as the impurities of dock water.

Regarding seaport salvage in general and its relation to shipping, there are approximately 50 seaports around the British Islands, and many wherein the largest vessels of the world can lie afloat for passenger and cargo services, and where many of them are built.

During one particular year, gross freights and revenues amounting to £300,000,000 were earned by British ships and the transport of 40% of all the ocean-borne commerce of the world. And yet, apart from the Salvage Associations, a few contractors, and the large seaports, which possess appliances available for the removal of wrecks in their own waters, ship salvage has in peace time no national basis, nor is plant maintained in the national interests. Perhaps this may be one of the future adjustments for national well-being.

Two large seaports contributed the only real wreck-lifting plant in 1939 for a heavy lift. The remaining 48 seaports referred to above, depend on these for such a service.

If we should eventually have the organisation advocated by the late Sir David Owen, and known as the "Co-ordination of Ports," this anomaly will disappear and wreck-raising and salvage plant will be equated to areas on a contributing basis.

Acknowledgments

Acknowledgments are due to the following sources for the use of data and material of interest on this subject:—

The General Manager and Officers of the Liverpool and Glasgow Salvage Associations for details of the raising of H.M.S. *Thetis*.

The Editor of the Transactions of the Society of Naval Architects and Marine Engineers, New York, for the use of photographs and material from Mr. H. F. Norton's paper, "Raising of the s.s. *Segovia*.

Thomas Mackenzie, Esq., Chief Salvage Officer with Messrs. Cox & Danks, Ltd., and Metal Industries, for material and information concerning the raising of the sunken German fleet at Scapa.

Concrete in Sea Water

*Continuation of Discussion**

Harry E. Squire,[1] Assoc.M.Am.Soc.C.E.: In purporting to advocate a revised viewpoint in regard to concrete in sea water, Mr. Hadley has actually presented a carefully prepared and plausible argument in favour of one of the oldest traditional viewpoints of this controversial subject—namely, that sea water does not attack "sound" concrete, or embedded steel that is adequately covered with "sound" concrete. The contrasting viewpoint is that sea water does attack Portland cement concrete and embedded steel whenever it comes in intimate contact with the cement paste or embedded steel, and that the only difference in durability between "sound" and "unsound" concrete is the time factor and intensity of exposure.

Before little if any concrete had been subjected to the sea water of the Pacific Coast, European engineers with a background of more than fifty years experience in marine concrete construction had likewise divided along almost identical lines of opinion.[2] On the Pacific Coast, the forms had barely been stripped from the early concrete before the same cleavage developed among those charged with responsibility for waterfront structures. The extravagant claims of advocates of the newly introduced "permanent" construction faded under the searching forces of sea water erosion which laid bare all manner of defects ignored under ordinary atmospheric exposure. Nevertheless, enough resistant concrete remained to encourage the proponents of "sound" concrete in their claim that all deterioration could be explained by the term "defective concrete." Improved understanding of concrete technology combined with improved methods of manipulation and manufacture have eliminated almost entirely the defects of the earlier structures; and these methods insure a service life of present-day concrete equivalent to the commercial life of most marine structures built. The controversy becomes more and more a question of academic rather than practical interest and, in the writer's opinion, might be automatically ended by setting up a definition of "sound" concrete in terms of sea water exposure—material which would withstand for a stated time (say forty years) a certain type of exposure (say tidal or complete immersion) with a stated loss of calcium (say 5%) or, if preferred, an equivalent gain in magnesium. Every one acknowledges that such concrete has been, and is being, manufactured, and most authorities will agree that such concrete is satisfactory for 90% of the structures built. The energy and enthusiasm of those proponents who refuse to acknowledge the mortality of concrete in sea water could then be concentrated on extending the frontiers of durability to really debatable periods beyond fifty years.

In studying the behaviour of "sound" concrete in sea water, the writer agrees that there is no better place to go than to the structures which have stood successfully for periods of from thirty to fifty years. However, the writer suggests that the next time the author emulates the prophet and "goes to the mountain," he take a core boring machine and a laboratory assistant with him. There have already been too many surface inspections of both sound and disintegrated structures and too much speculation as to what is going on under the outer skin of the concrete. This is well illustrated by one of the instances of "sound" concrete cited in the paper—namely, the breakwater test specimens exposed at San Pedro.[3] These experimental blocks are almost an exact replica of similar test specimens exposed by Russian engineers in the breakwater at Libau a decade earlier.[4] The Libau blocks were found to be sound under surface inspection but they were, nevertheless, blasted open and samples of concrete from the outside and interior were analysed and tabulated to show variation from the original cement. Quoting the concluding sentence of the report:

> "One fact, nevertheless, was certain—that the process of deterioration had already commenced and that it progressed, slowly perhaps, but none the less surely in the case of the mortars considered."

*Reproduced from Proceedings of The American Society of Civil Engineers. See Paper on this subject by Mr. Homer Hadley in "The Dock and Harbour Authority," June, 1941 issue.

[1]Assistant Chief Engineer, Board of State Harbour Commissioners, San Francisco, California.

[2]"Treatise on Dock Engineering," by Brysson Cunningham, 1904, Chapter 4, pp. 123-130.

Concrete in Sea Water—continued

The writer had the good fortune to make a visual inspection of the San Pedro specimens on the contractor's barge during coring operations. The concrete was sound but saturated even in the interior of the blocks. The cores were to be forwarded to the National Bureau of Standards for testing and analysis, but as yet (1941) no record of these tests comparable to the Russian tabulation has come to the writer's attention. The article referred to by the author[3] is merely a report of the surface inspection together with some photographs of the core specimens nicely crated for shipment—hardly sufficient information to warrant the author's rather positive statement that there was " no evidence of sulphate of magnesium attack." Physical and chemical tests of the core samples would give what the lawyers call " the best evidence " as to what attack, if any, has taken place and, if repeated on future cores, will give valuable data on the rate of attack.

The writer hopes that one of the organisations having funds available for research will find it advisable to make a systematic investigation of structures, successfully exposed to sea water, by means of core borings and laboratory analysis. The list of structures selected by Mr. Hadley would be satisfactory to begin with. No doubt, most waterfront engineers would like to add some pet structure to the list, in which case the writer would select the Ferry Building Foundation Wharf at San Francisco, Calif. This well-preserved structure, approaching its 50th anniversary and outliving its utility as a passenger terminal, is remarkable in that it violates some of the choicest taboos of sea water concrete practice. For one thing, the immersed concrete was mixed approximately one to eight and can hardly be considered impermeable; for another, the Dykerhoff cement used was of a reasonably high alumina content (approximately 11%) in contrast to the special cements of low alumina content advocated for sulphate resistance.

Most of the analyses available have been made of concrete that was badly disintegrated. Investigators seem to take a ghoulish interest in these misfortunes but have little time for successful structures. Invariably, these analyses show a partial replacement of calcium by magnesium. This has lead to the hypothesis, questioned by the author, that the disintegration is the result of sulphate of magnesia reaction with the calcium hydrate of the set cement.

Analyses of disintegrated concrete taken from a recent and somewhat disconcerting failure of good concrete in sea water (that of the concrete piles of the Ford Motor Company Plant at Long Beach, Calif.) indicated not only the usual increase in magnesia content at the expense of the calcium, but in addition a marked increase in the alumina content. Search for the source of the alumina led to the discovery of variable percentages of soluble alumina and active silica in samples of fine aggregate taken directly from the gravel pit. Submitted to the state mineralogist, the samples were identified as mixtures of quartz particles with varying percentages of feldspar particles, the feldspar being partly kaolinized.

The disintegration was confined to that part of the pile below the line of immersion, and was spotted in a most irregular manner over the entire wharf structure. The conclusion was inescapable that it was due to chemical reactions caused by the sea water; the variation in the behaviour of the piles could readily be attributed to variations in the percentage of deleterious feldspar in the aggregate. A marked characteristic of this disintegration was swelling in volume of the concrete affected. The formation of sulpho-aluminates (alums) with their great capacity for increase in volume by taking up water of crystallisation has been suggested as the primary cause of this type of breakdown. No matter what the theory, whether due to replacement of calcium by magnesia, to the formation of sulpho-aluminates, or of complex silicates from the active silica of the sand, the fact remains that exactly the same phenomenon of disintegration was simulated in the laboratory, by A. A. M. Russell, Assoc.M.Am.Soc.C.E., using the suspected sand mixed with local cement and immersion in San Francisco Bay water. The breakdown of the mortar was similar to what occurred in the Long Beach piles exposed to sea water.

The writer questions the author's opinion that disintegration is primarily the result of physical and mechanical forces rather than chemical, but he agrees that most breakdowns occurring in less than 25-yr exposure may be attributed to two kinds of defective concrete:

(a) The use of mixes having a deficiency of cement; and
(b) The placing of mixes in excessive water (not merely wet mixes but concrete drowned by leaky forms or by an accumulation of water in tight forms).

Both are probably phases of the same fundamental defect—concrete in which the water-cement ratio is so high that water voids or loose crystallisation admits the sea water into ready contact with the cement paste.

After studying the breakdown occurring in the piles at Long Beach and also experiments made by Mr. Russell on a large number of puzzolan admixtures which showed that many substances containing active silica or alumina produce unsound briquets, the writer is convinced that a number of failures previously attributed to improperly proportioned or placed concrete have been accelerated, if not primarily caused, by aggregates which yield alumina and silica capable of reacting with the substances in the set cement paste and with the sea water; and that the superior behaviour of some successful structures is due in large measure to the inert nature of the aggregate. In this type of failure, the expansion resulting from internal chemical activity seems, progressively, to open up the structure of even superior concrete to the sea water salts.

In regard to the other ailment which afflicts concrete in sea water —the corrosion of embedded steel—experience has revealed one optimistic fact. Below the level of immersion, corrosion appears to be completely inhibited and the embedded steel appears to be quite as permanent as wood below the ground-water level. In tidal waters this immunity extends to about the mean high-tide line.

Above the high-tide line a very different condition prevails, and when the surface is subjected to intermittent splashing and drying out, superior concrete in thicknesses ordinarily specified in reinforced concrete practice will not protect against cracking and spalling from expansion of the corroded steel. Greater depths of cover may prevent this type of damage because there is a depth at which the shearing resistance of the concrete cover exceeds the pressure of the corroding materials; but the absence of cracking or spalling is no assurance that corrosion is not in process. Where small bars are used, they will frequently rust away entirely without showing surface indication. Furthermore, corrosion is sometimes localised, the same rod rusting entirely away at one point and having full section not more than a few feet away. The writer never has been able to satisfy himself that if the corrosion of a 1-in. rod cracks 1-in. of cover in from ten to fifteen years, it may not crack 2-in. to 3-in. in thirty to forty years or it may even rust off entirely. Here again is a place for field investigation to determine the relation between depth of cover, impermeability, and rate of corrosion. Perhaps the investigators will conclude, as the writer has, that it is easier to seal the concrete off from sea water moisture than to obtain a convincing answer.

In the " Summary " Mr. Hadley makes a significant statement which rings responsively in the writer's mind:

> " The harm resulting from misunderstanding a natural phenomenon arises from the likelihood that measures adopted to effect changes and alterations in it will be misdirected."

There are few branches of engineering construction in which methods are more divergent and in which those engaged in the work more individually opinionated than in marine concrete work. Under the guise of producing resistant concrete, engineers resort frequently to the most extreme measures in proportioning, in the use of water, in surface treatments, in manipulation, and in the use of admixtures—measures which are frequently so onerous that they defeat their purpose by diverting attention from simple but necessary requirements. Much of this effort must be misdirected because the writer has rarely seen more than one or two of these extreme requirements applied simultaneously by any one engineering organisation.

In addition, many practices are contradictory. Thus, in one case, there is the exhibition of two groups of eminent engineers charged with the same problem of constructing bridge piers in harbour waters—the one group, adopting a special cement with a specially low alumina content, and the other prescribing a special puzzolan cement in which an activated alumina silicate is added to the normal alumina content; in another instance, the paradoxical practice of two large harbour organisations in which one protects the concrete under water to the extent of impregnating it under pressure with asphalt but ignores the surfaces above water, whereas the other carefully seals the above-water surfaces but exposes the under-water surfaces without protection to the ocean sea waters.

The best proof of the ability of ordinary, good concrete and standard Portland cement to withstand the usual sea-water exposures is the fact that so many structures have given a good account of themselves in spite of extraordinary procedures resorted to in the name of producing resistant concrete. The writer agrees that it is highly desirable to clarify the concrete technologist's viewpoint and attitude when he comes down to the sea; but he believes that the way to do it is to probe into existing structures and discover what changes in structure and chemical content have occurred. Only by knowing what has happened in the first fifty years can one judge what may be impending in the next fifty or hundred.

J. W. B. Blackman,[5] M.Am.Soc.C.E.: Referring to Mr. Hadley's paper, it is noted that observations on marine structures are confined to the Pacific Coast. It is further noted that the paper deals only with disintegration of Portland cement structures from the action of sulphate of magnesium. This very much limits the discussion.

[3] "Western Construction News," June 25th, 1932, p. 367.

[4] "Proceedings," International Association for Testing Materials, 6th Congress, New York, 1912, Second Section, XVII.

[5] Consulting Engineer, Long Beach, California.

Concrete in Sea Water—continued

It must be stated that there are very few Portland cement concrete structures north of San Francisco. Since the seaports of the Pacific Northwest—in Washington, Oregon, British Columbia, etc.—are in a timber country, creosoted piling is used extensively for construction of their marine works. The San Francisco Bay area and the Los Angeles and San Diego Harbours are where the greatest number of concrete structures exist.

Portland cement concrete, when exposed to sea water and sea air, is subjected to many causes of deterioration and disintegration other than the action of sulphate of magnesium (which is generally considered as secondary by engineers engaged on the construction of marine work). Mr. Hadley has mentioned the many other attacks of various kinds.

It may be well to summarize briefly some of the various causes of action that the writer has encountered. In driving pre-cast concrete piles, many hazards are met before the pile reaches its final position. Assume that the concrete mixture has been carefully designed, the mineral aggregates tested, the concrete compacted by careful vibration, a minimum quantity of water used, constant inspection by experienced men, and not less than 3-in. of cover for the steel. Then, with a perfectly impervious and well-protected pile cast ready for transportation, there are yet many hazards to guard against. It must be lifted and carefully handled at the point of driving. It must be placed in the pile-driver leads and driven with a hammer whose weight is proportioned to the size and weight of the pile. The amount of driving that the pile is to be subjected to is to be governed generally by the experience of the engineer and the type of soil it penetrates. Where piles are held entirely by friction, some engineers prefer to jet most of the way down, only driving the last few feet, whereas others prefer to drive the entire distance, if possible.

There is a difference of opinion between some engineers as to the amount of driving that a pile should receive. It is not necessary to elaborate in detail on Mr. Hadley's paper with regard to the many types of failure to which concrete is subjected, but briefly they appear to be as follows: Poor workmanship, faulty mineral aggregates, poorly designed mixtures, too much water, insufficient cover of reinforcement, cracks due to shrinkage, handling, and driving. Porosity is one of the greatest causes of failure. It allows the moisture to gain access to the steel reinforcement, causing ready oxidation and steel expansion which, in turn, spalls the concrete. Many writers have demonstrated that there are two distinct causes of failure—one due to mechanical action and the other to chemical decomposition.

Porous concrete can be disintegrated by forces exerted by the crystallisation of salts in its pores. This condition is accelerated by the constant wetting and drying of concrete exposed to the wave action of sea water. The continuation of this process creates surface cracks, which are caused by this building up of crystals and concentration of the salts, and will in time cause deterioration of the concrete both by mechanical and chemical action. It is apparent, therefore, that all concrete exposed to sea water and sea air must be as impermeable to water as it is possible to make it.

The writer was asked to inspect a wharf built some few years ago in Long Beach (Calif.) Harbour. A large number of the concrete piles were in a serious stage of disintegration. The concrete in which disintegration showed was swollen and disrupted, and this condition appeared to be more acute on the upper side of the batter piles. Repairs to the structure cost about $250,000. In the opinion of some engineers the disintegration was due to feldspar in the small aggregates. In the opinion of others the damage was due to other causes. It is interesting to note that a large number of the piles adjacent to those disintegrated showed no apparent decomposition. Is it to be assumed that the cause of the disintegration was due to faulty workmanship? For instance, some of the piles may have been compacted carelessly, there may have been too much water, and the porosity may have been much greater than that of the adjacent piles that were not injured. This raises a question that is difficult to answer.

The Portland Cement Association has, with wisdom, recommended[6] as follows: "For unusually severe exposures, as in sea water, etc., a clear cover of 3-in. is recommended at least for the portion of the pile where such exposure is encountered." Some cement companies have placed on the market brands of cement such as "sulphate resisting cement," "high-silicate cement," etc. The chemists of cement companies have been endeavouring to find a remedy for attacks on cement concrete exposed to sea water and sea air.

Concrete in the soffits of slabs and beams is just as vulnerable as other parts of concrete structures to disintegration or deterioration from the various causes mentioned. Hence, various methods of protection have been tried, some of which have proved successful.

Reference is made by Mr. Hadley to the small ferry wharf at North Vancouver, B.C., Canada. The writer knows this structure well and has inspected it. He feels that where such examples are cited, for comparison, the following additional information should be supplied:

(1) The structure is built on columns (not piles). Had piles been used instead of columns, they would have been subjected to the stresses of handling and driving, which in many cases creates cracks. This in time readily admits sea air and salt water.

(2) The salinity of the Burrard Inlet (North Vancouver) is much less than that of the open sea because large bodies of fresh water are discharging all the year round from the creeks upstream and downstream from the ferry wharf.

Mr. Hadley's statement that the protective measures of asphalt impregnation of concrete piles, as used in Los Angeles Harbour, are thoroughly effective as to impermeability and density is interesting. A recent inspection of the same type of piles in Richmond Harbour, Calif., and San Diego Bay, shows that these piles are in excellent condition. Some of the piles in Los Angeles have been in use for twenty years.

[6] "Concrete Piles," Portland Cement Association, November, 1939, p. 28.

Notable Port Personalities

XIV.—Sir Thomas Brocklebank

Sir Thomas A. L. Brocklebank, the recently elected Chairman of the Mersey Docks and Harbour Board, is the fourth baronet in the succession, and represents the sixth generation of his family to be engaged in shipping affairs. Born in 1899, he was educated at Eton and Trinity College, Cambridge, and in 1922 joined the firm of Thos. and Jno. Brocklebank, Ltd., of which he became a director in 1927.

SIR THOMAS BROCKLEBANK.

He succeeded his father, the late Sir Aubrey Brocklebank in 1929, and became a member of the Mersey Docks and Harbour Board in the same year. He was the first member to be elected Deputy-Chairman when that office was created in 1938, owing to the illness of the late Sir Richard Holt, Bart., who was then Chairman. After Sir Richard's death he was elected Chairman in April last.

Sir Thomas is also a director of Cunard-White Star, Ltd., the Cunard Steam Ship Co., Ltd., Midland Bank, Ltd., London, Midland and Scottish Railway Co., and Crosfields Oil and Cake Co., Ltd., and is Chairman of the Thames and Mersey Marine Insurance Co., Ltd.

Obituary

The death has been announced of **Alderman George Gasgoigne,** a representative since 1921 on the Tyne Improvement Commission of the Borough of Tynemouth, of which he was formerly mayor. He was closely identified with the fishing industry of the district and was a member of the Cullercoats Harbour Board, as well as of other bodies. He was chairman of the Harbour and Ferry Committee of the Tyne Improvement Commission.

The death has also taken place at Sunderland of **Sir John Priestman,** a well-known shipbuilder and shipowner, who was for many years a member of the River Wear Commission and took a great interest in shipping and port affairs at Sunderland. He was knighted in 1923 and received a baronetcy in 1934.

Gates for Lock and Dock Entrances

An Article for Students and Junior Engineers

By STANLEY C. BAILEY, Assoc.M.Inst.C.E., F.G.S.

(Concluded from page 214)

Rollers and Roller Paths

In some large steel gates rollers have been fitted to the underside of the gates near the mitre posts, travelling on a radial cast steel roller path in lengths of about 5ft. bolted down to granite blocks.

The plummer block bearing on the axle of each roller is pivoted on one side to the bottom of the gate, and on the other there is a socket into which fits a vertical forged steel spear or rod about 6 in. dia., which is carried up the gate near the top where it is forged to a square section having slotted holes for a gib and cotter which pass through the steel plate jaws of a bracket fixed to the top of the gate. In some cases a strong helical spring is fitted to the top of the spear. Rollers of cast steel up to 3ft. dia., with 7 in. dia. axles have been used, with 1¼ in. thick mud scraper plates of steel on each side of the wheel.

The safe load on cast steel wheels and rollers in lbs. P=S.D.T. where S=600 to 840lb. D=Diameter of tread in inches, and T=width of tread in inches.

Rollers are not much used in modern gates, as they increase the friction, and are liable to be obstructed by sand, stones, and mud, and even metal dropped in the entrance from the coping or from passing ships, and should they ride over the obstacles, the gates, anchorages and machinery will be considerably strained.

Locking Mitre Posts

There are several methods adopted for locking the mitre posts together at the top. The simplest for small gates is to pivot a U-shaped steel bar about 3in. by 1in. to 4in. by 1½in to the top of the mitre post of one leaf, and drop it over the top of the post on the opposite leaf.

Another method is to fix large, strong steel angles to each mitre post at the top, with a hole 3in. in diameter in each vertical flange through which passes the piston of a horizontal hydraulic ram, fixed on the top of one leaf, or a square bar may be used with a rack and pinion, worked by a hand wheel on a vertical shaft.

In some gates a vertical cranked lever is used, having at the end of one arm an inverted U-shaped clamp, this is pivoted near the end of one post, and drops over a projecting bar on each mitre post. The cranked bar is operated by a handle and connecting rod fixed to a stanchion on the gate.

For single leaf gates, the mitre post is locked to the entrance wall by a short horizontal bar worked by a rack and pinion below the coping level, the pinion being attached to a vertical shaft operated by a turn key.

Another method for locking double leaf gates is to fix a short vertical pin from 3in. to 4in. dia. on the top of the mitre post of one leaf, and on the other, the piston of a horizontal hydraulic ram actuates toggle links pivoted to the post, and to the head of the ram piston, which operate a pair of steel jaws pivoted to the post, and which fit round the vertical pin on the other leaf.

The Panama Canal lock gates are held together in a similar manner, except that the motive power is an electric motor running at 730 R.P.M. with mitre wheels gearing it to a solenoid, and to a screwed shaft on which a block travels, to this block the toggle links are pivoted that operate the jaws, which engage with a 6in. dia. pin on the post of the opposite leaf.

Most steel- and timber-built gates are fitted with horizontal fenders of creosoted elm from 9in. by 4in. to 12in. by 6in., and also in some instances with vertical fenders on the outside from the top deck to about 5ft. below L.W.S.T. level, the fenders being fixed by galvanised bolts ⅞ in. dia. to angle steel cleats on the gate.

Strut Gates

Strut gates are used to steady the main gates during extraordinary high tides and rough weather in lieu of constructing additional storm gates, and have also been used in conjunction with the latter.

They are built of either timber or steel framing, with horizontal beams spaced according to the depth of water and pressure to be sustained, but have no planking or skin plating.

Timber-built strut gates are formed of 9 in. by 9 in. to 13 in. by 13in. timbers with diagonal steel tie bars on each side from the top of the heel post to the bottom of the mitre post, and fitted with steel or iron straps and plates at the joints, fixed by 1¼in. dia. bolts.

Steel strut gates consist of steel joists in the framing and struts, with diagonal struts from the top of the mitre post to the bottom of the heel post, and cover plates at the joints.

The gates are usually made about three-quarters to two-thirds the height of the main gates, and have heel posts, quoins in the masonry of the entrance, also gudgeons, pivots and anchorages, as in the main gates, but on a smaller scale, while the bottom pivot is fixed to a stone or concrete pedestal in the outer corner of the main gate recess.

The mitre post bears against a vertical timber wedge-shaped post on the main gate, having timber chocks or angle steel stops on the outside of the vertical timber attached to the main gate. The strut gates engage with the main gates at a distance of from ½ to ¾ of the way from the heel posts of the latter

Machinery for Operating Gates

Various methods are employed for operating gates, the simplest, which is much used in those of canal locks, consists of a long square timber lever attached to the upper part of each leaf of the gate, and extending about 10ft. over the shore end. When the water is level on each side of the gate, it is easily operated by hand, but a slight difference in the water levels is sufficient to make it more difficult. Iron foot treads are provided on the wharf to press against. In some cases a chain is fixed to the end of the lever and passed round a pulley near the edge of the coping and from thence to a winch, to the barrel of which it is attached. Another chain wound on the barrel in the opposite direction is also fixed to the lever end, the gates can thus be opened or closed by one winch on each side of the entrance.

The usual method of operating larger gates consists of attaching a chain to each leaf of the gate near the mitre post, and at about ⅓ of the height from the cill level on each side, the chains being conveyed to the entrance walls where they pass over pulleys and through horizontal pipes, terminating inshore at vertical shafts with pulleys at the bottom, where the chains are attached to steel or iron wire ropes leading to winches over the shafts, four winches are thus required to operate the gates.

In some cases a barrel is placed at the bottom of each shaft, and the vertical shaft of the barrel terminates in a capstan head with toothed wheel and pinion sunk below the coping level, and worked by four portable levers.

In the overgate system of operation, the opening and closing chains are fixed to the walls of the entrance at ⅓ of the height from the cill. The opening chain of each leaf then passes round a vertical pulley fixed near the mitre post, and then over another vertical pulley at the top of the gate, where a steel wire rope is attached to it, this is conveyed along the top of the gate to the shore, where it passes round a pulley on top of the heel post, or in another convenient position close to the heel post, and from thence to a winch. A similar method is adopted for the closing chains, which are slackened out when the gates are being opened and lie on the floor of the cill and entrance.

It is advisable to use chains in lieu of wire ropes for the submerged portion of the gear as they will not rust so readily and will lie flat on the floor of the entrance, and not reduce the width of the waterway. Four winches are required to operate the gates on this system, but where hydraulic power is available, horizontal or vertical jigger rams are used, arranged in pairs, in pits, on each side of the entrance.

Some gates are operated by quadrant lever racks of malleable cast iron, or cast steel which are pivoted near the mitre post of each leaf, and near the top of the gate, the radii of the racks being struck from the gate pivots, with the teeth on the outside. The racks engage with pinions below coping level, that are fixed to the vertical shafts of captans worked by manual labour.

The quadrant shaped gates at the Port of Stockholm have a rack on the outside of the quadrant of each leaf, and are also operated by a ponion in conjunction with a capstan.

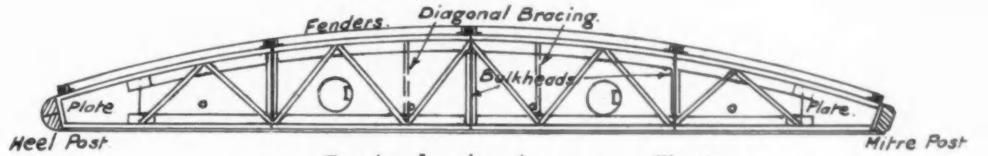
In some cases the capstans and winches for working the gates are driven by electric motors, or by horizontal hydraulic engines of the oscillating cylinder type.

The use of vertical hydraulic multiple sheave jigger rams involves the construction of deep pits below the coping level, but the wall thickness is less than is required for horizontal rams. Falling gates of the Edward Box type have been worked by vertical oil presses under a pressure of 1,400 lbs. per sq. in., and by vertical jigger rams with wire ropes to the gate, and also by electrically operated winches, and in one instance by a single wire rope to a power capstan on one side of the entrance, the rope passing over suitably placed double sheaves at each end of the gate on top, and from thence to the capstan.

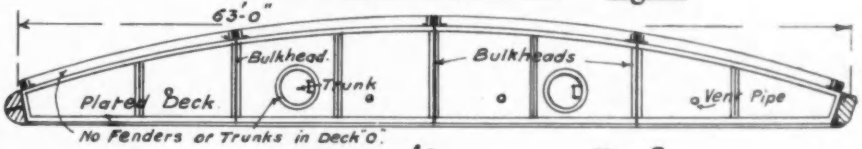
Another method which is often adopted is to employ direct acting horizontal hydraulic rams sunk in pits below the coping level. At the crosshead of the ram piston a pivoted or gymbal joint is attached with a long lever to the gate where there is another gymbal joint, at a point about half way along the length of the gate just above H.W.S.T. level.

The pressure applied to the rams is from 700 to 750 lbs. per sq. in., which is reduced to 250 lbs. per sq. in. by escape valves.

Gates for Lock and Dock Entrances—*continued*

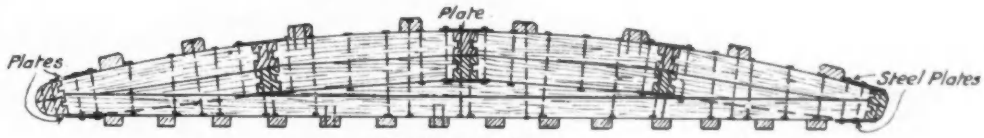


Decks. b.c.d.e.g.h.J.K.m.n. Fig. 7.



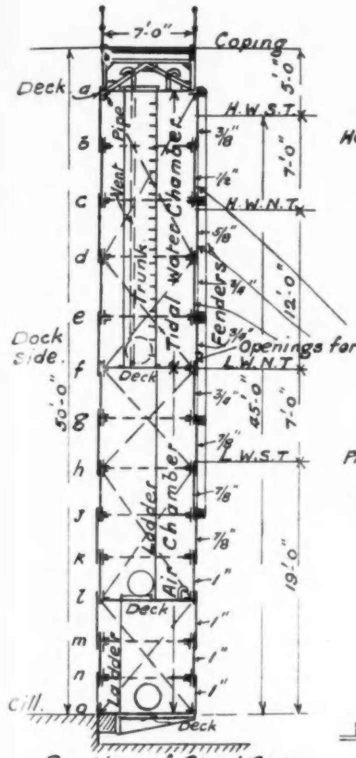
Decks. a.f.L.o. Fig. 8.

Plans of Steel Gate



Plan of Timber Gate.

Fig. 10.



Section of Steel Gate.

Fig. 6.

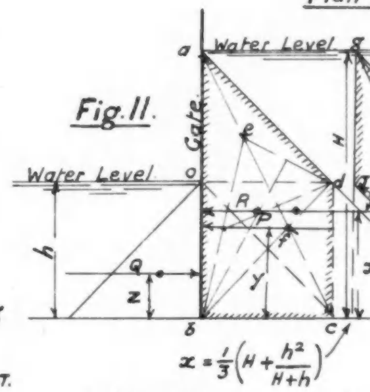


Fig. 11.

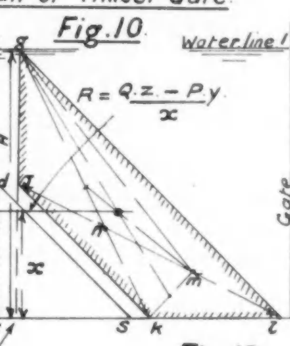


Fig. 12.

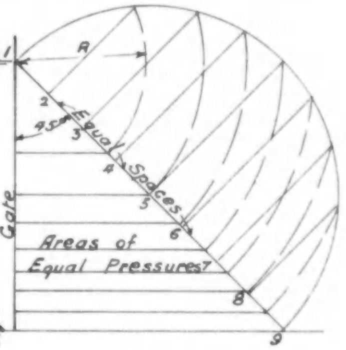
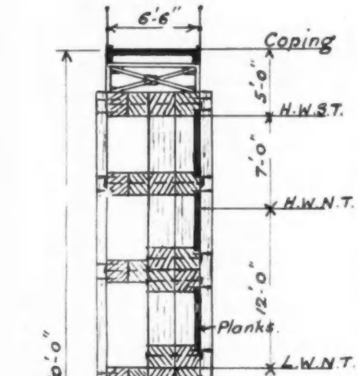
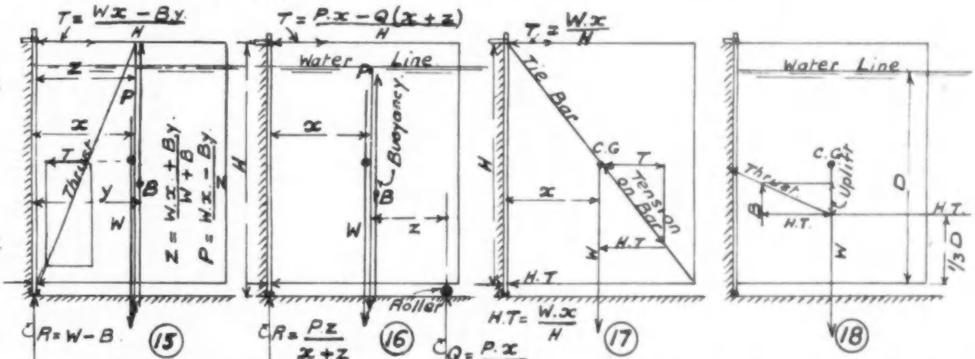


Fig. 13.



Section of Timber Gate.

Fig. 9.



Gates open in Water. Gate open in Dry. Gate closed in Water.

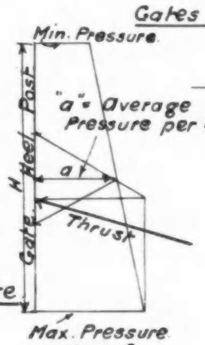


Fig. 14.

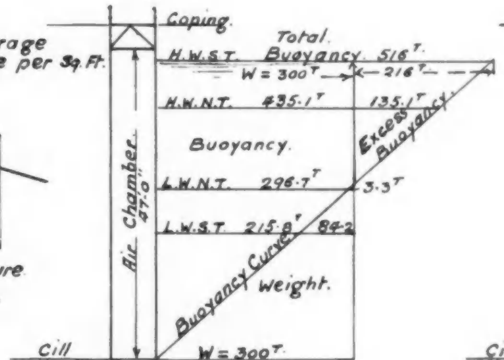


Fig. 19.

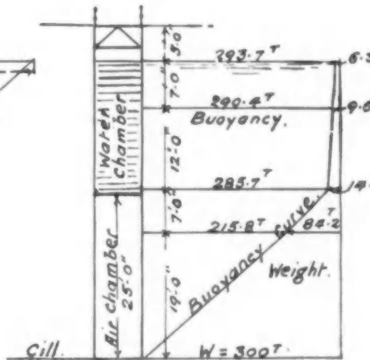


Fig. 20.

The lever being in compression when closing the gate should be calculated as a column with pin ends, and having equal strength in each direction, particular attention being paid to the ends where the cross section is reduced.

The disadvantage of this method is that the power is not applied to the gates in the best position, which should be at the point of maximum water pressure, or ⅓ of the depth of water above the cill, but the rams can be placed in the walls in this position in a deep pit, with a culvert for the lever, and a dam with a striffing box through which the piston of the ram passes at the inner end of the culvert, this would involve much thicker walls

In some instances the lever from the horizontal ram is pivoted to another one lying on top of the gate longitudinally at about ⅓ of the distance from the heel post. This latter lever, known as a "crocodile lever," is pivoted at the top of the heel post, and is continued for ⅔ of the length of the gate, where the outer end is attached to a strong cross girder on the gate; the pressure from the ram is thus transmitted further along the gate, and the necessity of a long lever to the ram is obviated. In cases where hydraulic or electric power is used, it is advisable to provide hand-worked or power capstans and fairleads on each side of the entrance, so that the gates may be operated by ropes or chains should the machinery fail.

The gates on some small floating docks are worked by a winch on each leaf of the gate, the opening and closing chains pass

Gates for Lock and Dock Entrances—continued

round the barrel in opposite directions, thence over pulleys and down the sides of the gate to pulleys near the bottom and then to the side walls of the dock, where the ends of the chains are fixed. In this type of dock the floor of the pontoon is submerged.

Some gates are operated by an endless steel wire rope about 5 inches in circumference, and a horizontal lever pivoted to the gate at about $\frac{1}{3}$ of the height above the cill.

The lever passes through a culvert in the wall, and at the inner end there is a crosshead, the ends of which travel in guides on the side walls of the culvert. A bracket on top of the inner end of the lever is attached to an endless wire rope which passes round a pulley at each end of the culvert, the outer pulley being placed in a vertical recess in the wall face.

At the shore end of the culvert there is a vertical shaft at the top of which below coping level is a 3 cylinder reversing hydraulic oscillating engine geared to a winch, the engine being about 25 B.H.P. The wire rope passes up the shaft to the winch, and from thence through a horizontal trench to a pulley at the top of the recess in the wall face, and then down to the pulley at the bottom and through the culvert to the inner end of the lever.

The steel cellular gates of the Panama Canal locks are operated on another system, consisting of a lever arm to each leaf placed 2ft. 6in. below the coping level, and attached to the gate by a pivot and spring, at a distance of 17ft. 6in. from the heel post, the length of the leaf being 65ft. for an entrance 110ft. wide. The shore end of the lever is pivoted to the circumference of a horizontal toothed wheel 20ft. in diameter, this engages with a pinion 15in. in dia. and on the shaft of the pinion is a mitre wheel engaging with another on the shaft of a 5ft. 6in. dia. toothed wheel that is connected by gearing to an electric motor.

Strut gates are operated either by direct acting horizontal hydraulic rams placed in a pit below the coping level, with a lever pivoted to the top of the gate and to the ram crosshead; or by means of chains to winches; in which case the hauling-out chain is attached to the mitre post on the outside, and at about $\frac{1}{3}$ of the height of the gate from the bottom, it then passes to a swivel pulley at the same level fixed to the main gate, and vertically up to a pulley on the top, and from thence to a horizontal pulley on the top of the strut gate, and along the top of the gate to a pulley on the wall near the heel post, passing through a culvert and round another pulley at the bottom of a shaft leading to a winch at coping level.

The hauling-in chain is fixed to the inside of the strut gate mitre post at about $\frac{1}{3}$ of the height from the bottom, and is conveyed to a culvert in the wall, terminating in a shaft, then round pulleys to a winch at coping level.

The gates may also be worked by ropes in connection with multiple sheaves on horizontal hydraulic jigger rams.

Entrance Booms and Chains.

To guard against ships coming into collision with gates before they are opened, floating booms of baulk timber are used in some entrances, they are held by chains to a bollard on each side of the entrance, and are pulled clear of the entrance alongside the wall when necessary.

In other cases a strong chain is stretched slackly across the entrance above H.W. level, it is fixed to the wall on one side and on the other it passes round a fairlead to a double purchase winch or power capstan at coping level. When released, the chain lies on the floor of the entrance, and in some instances a double system of chains is used, being spaced some distance apart.

Calculations.

The strength of gates for locks, wet docks or basins may be calculated for H.W. on one side and L.W. on the other, but for dry docks the calculations must be made for H.W. on one side and no water on the other.

In flat, single leaf falling gates, the horizontal ribs are beams with free ends, and the bending movements and shears should be calculated as such; and in single leaf flat gates, and also in cambered gates with double leaves, mitre, and heel posts, the horizontal ribs will be beams fixed at the heel post end, and free at the other, and the bending moments and shears for beams of uniform section will be as shown in the diagram Fig. 5., the B.M. at the heel post being $\frac{W.L.}{8}$ Should the beam not be of uniform section the B.M. at this post will be= $\frac{W.L.}{6}$ In arched gates and in those with cambered outer faces, subject to radial water pressures, the line of thrust will be a curve, the gate acting as a three pin arch, and the horizontal thrust will be equal to $\frac{W.L.}{8.V.}$ where W=total load on both leaves, L=width of entrance to centres of heel posts, and V=the versed sine or rise of gate from a line drawn through the centres of the heel posts to the point of contact of the mitre posts, as shown in the diagrams Figs. 1, 2 and 3. Or the horizontal thrust= $\frac{P.x.}{V}$ where P is the total load on one leaf acting at the centre of gravity of the pressures at a distance x from the heel post measured normal to P, and $x= \frac{M}{P}$ where M= the total moments of the loads on one leaf.

*Figs. 1 to 5 are to be found in the August issue.

If the line of pressure or thrust coincides with a vertical line drawn through the C.G. of any vertical cross section of the gate, then the design of the gate may be considered economical. In double leaf flat sided gates, the line of thrust is a straight one from the mitre to the heel posts, and the ribs are beams with one end fixed and the other free, being also subject to end compression, as in a column with vertical and lateral loads.

The graphic method of finding the thrusts is shown by Fig. 4, where the loads P and Q are resolved into R acting at the mitre posts. The horizontal ribs between the watertight decks are usually braced between the outer and inner skin plates, and the vertical ribs are beams with fixed ends. The horizontal and inclined thrusts will increase the less the rise of the cill is made..

As regards the skin plating, a vertical strip of this between the horizontal ribs can be regarded as wholly in tension, and its thickness may be calculated by either of the following formulæ, viz.:—

$$T = \sqrt{\frac{L.^2H.}{44\ 800}} \qquad T = 0.074\sqrt{H.} \qquad T = 0.00465\ L\sqrt{H.}$$

where T=thickness of plate in inches, L=span between ribs in inches and H=depth of water in feet.

The calculations for the strength of the pivots and anchorages should be made for the condition that the gates are hanging in the dry as they would be if erected in sitû.

The coefficient of friction between the heel post and the hollow quoin varies between 0.103 and 0.194.

Figs. 6, 7 and 8 show a cross section and plans of a steel cellular gate for an entrance width of 120ft. the cill having a versed sine of 20ft. and Figs. 9 and 10, the section and plan of a timber built gate for an entrance of similar dimensions.

When the water is not at the same level on each side of a gate as shown in Figs. 11 and 12, the resultant pressure $R = \frac{Qz - Py}{x}$ and $x = \frac{1}{3}\left(H + \frac{h^2}{H+h}\right)$ where x is the height of the centre of pressure above the base, and H.h. the maximum and minimum depths of water respectively. R acts through the centre of gravity of either of the figures a, b, c, d or g, j, k, l.

In Fig. 11 the C.G. is found as follows, viz.:—draw diagonals a, c and b, d. Make a, e=c, f and complete the triangle e, b, d and find its C.G. which will be the C.G. of the area a, b, c, d.

Similarly in Fig. 12, make lm.=Jn. form the triangle and find its C.G.

Fig. 13 illustrates a method of finding the areas of equal pressure at various positions in the height of a gate, and in Fig. 14 are shown how the max. and min. pressures on the heel post due to the thrust on the gate, can be obtained.

Figs. 15 and 16 show how the tension on the top pivot, and the pressure on the roller are calculated, W being the dead weight of the gate, B=the buoyancy, and P=the resultant which equals

$$\frac{W.x - By}{z} \text{ and } z = \frac{W.z. + By}{W + B} \quad \therefore W.x. - B.y. = P.z.$$

The tension on the tie bar of a timber gate is found graphically as shown in Fig. 17, and Fig. 18 illustrates the direction taken by the thrust line when affected by buoyancy or uplift.

Buoyancy.

The buoyancy of steel cellular gates with double skin plating and with air and tidal water chambers should be such that at H.W.O.S.T. there is a slight preponderance of weight over buoyancy to reduce the tendency of the gates to be lifted off the lower pintle block which has happened in some instances. The maximum strains on the pivots and anchorages when the weight preponderates at H.W.S.T. will therefore occur under ordinary working conditions at L.W.S.T.

In calculating the buoyancy, the displacement of the heel and mitre posts, clapping cill and fendering, also the steelwork immersed in water must be allowed for, in addition to that of the air chamber, allowing 35 cub. ft. per ton for salt water, and 36 cub. ft. per ton for fresh water. Steelwork at 490lb per cub. ft. will displace 4.571 cub. ft. per ton. Buoyancy curves are shown in Figs. 19 and 20 for steel cellular gates for a dock entrance 120ft. wide, with a 20ft. rise of cill, and 43ft. depth of water at H.W.S.T., the dock being empty of water, and varying tide levels on the outside.

Fig. 19 is for a gate having an air chamber throughout, and Fig. 20 for one with an upper tidal water chamber and an air chamber below to the bottom of the gate for a height of 25ft. Should there be a 12ft. high central air chamber with tidal water chambers above and below, the latter being 20ft. high, there will be a preponderance of weight at H.W.S.T. of 151 tons; but if the air chamber is 20ft. high, and there are tidal chambers above and below, the latter being 5ft. high, the excess of weight over buoyancy at H.W.S.T will be 62 tons.

The dead weight of the gates is based on an average weight of 1.9cwts. per sq. ft. of total gate area to coping level.

Select Committee on National Expenditure

Replies from Departments to Recommendations on Port Working

The Select Committee on National Expenditure have issued their 18th Report containing replies from the Administrative Departments to recommendations made in earlier reports. The following extracts from a memorandum by the Ministry of War Transport relate to recommendations in regard to ports and port operation:—

Port Work During Warnings

Recommendation 1: " There should be no cessation of work in ports during ' alerts ' unless danger is imminent."

Arrangements have been made at all ports for a " spotter " system to operate during daylight hours and work does not cease unless imminent danger is present.

Additional Mechanical Equipment

Recommendation 2: " Delivery and/or transport of additional mechanical equipment for ports should be speeded up."

The Ministry of Supply has appointed a committee composed of representatives of that Department and the Ministry of War Transport, and also of crane manufacturers, to create and maintain by every possible means an adequate supply of cranes and other mechanical equipment wherever thy are needed for war purposes. The committee is in touch with the principal manufacturers, who are expediting the construction and supply of all cranes and other mechanical equipment on order. Mobile cranes for which orders had been placed in U.S.A. are now beginning to arrive.

Transfer of cranes and other equipment has been arranged from East to West Coast ports and satisfactory pooling arrangements have been made at the major ports. Up to the end of June, 1941, the following transfers had been effected:—

Cranes	82
Electric trucks	104
Hand trucks	157
Dock locomotives	25

Special Types of Railway Wagon.

Recommendation 3: " Manufacture of railway Wagons of special types should be accelerated."

The shortage of bolster wagons for conveyance of imports of steel in long lengths experienced last year, has been met by the construction or improvisation of some 2,630 bolster wagons representing 5,400 ten-ton units. In addition steps have been taken to secure better distribution and more intensive use of the available stock by means of an improved system of central wagon control and the establishment of dumps in which material forwarded in excess of the current rate of intake of consignees can be deposited instead of remaining in the wagons.

Co-operation in Loading Abroad

Recommendation 4: " Closer co-operation at oversea ports between the Ministries of Shipping and Transport should be considered, in order that cargoes may be more suitably arranged with a view to their ultimate destination."

Before the amalgamation of the former Ministries of Transport and Shipping it had been arranged that two senior representatives of the Railway Executive Committee should visit the United States and Canada, from which countries alone shipments with undetermined destinations are likely to give rise to difficulty. The amalgamation makes this matter no longer a question of closer co-operation between individuals and Ministries. Instructions given to these representatives have linked them with the Ministry of War Transport's shipping organisation in New York, which had been established by the Ministry of Shipping under Sir Ashley Sparks.

A report has just been received from the railway representatives, in which Sir Ashley Sparks concurs, dealing with the position in the United States, and suggesting directions in which further improvements might be secured if it is possible for the importing Ministries concerned to furnish additional information in advance as to the area of consumption of commodities included in the shipping programme. The points raised are being closely examined without delay and a further report will shortly be rendered dealing with the position in Canada.

Reconstruction of Icelandic Ports.

An agreement has been entered into with the Government of Iceland by which extensive additions and improvements to the harbour facilities of the island will be made by the United States in virtue of their temporary occupation. The United States Government will provide the necessary material and employ native labour, being given in return absolute priority in the use of the harbours.

National Harbours Board of Canada

Excerpts from the Annual Report for the Calendar Year 1940

Shipping and Cargo Tonnage

The aggregate volume of shipping at harbours administered by the Board was substantially greater during 1940 than in the previous year. Vessel arrivals numbered 46,100, which was 5,206 over the number of entries in 1939. The aggregate net registered tonnage was 36,658,366 in 1940, as compared with 33,997,984 in 1939.

The volume of water-borne cargo tonnage showed a moderate increase over the previous year. In 1940, 30,048,502 tons (W. or M.) were carried, as compared with 29,694,157 tons in 1939.

The movements of vessels and the classes of cargo carried have naturally been influenced considerably by the necessities of the war, and the changes which have taken place have affected different harbours in varying degree.

Revenues and Expenditures

Operating revenues in 1940 were the highest in the experience of the Board, amounting to $10,602,199 and showing an increase of $1,509,058, or 16 per cent. over those of the preceding year. Expenses of administration, operation and maintenance required $4,506,827, a figure exceeding that of the year before by $248,006, or almost 6 per cent. In large part, this increase in expenses was attributable to the operations of terminal railways, grain elevators, cold storage plants and shore and floating equipment, all of which showed commensurate increases in earnings. Operating profit for the year was $6,095,372, as compared with $4,834,319 in 1939, an increase of $1,261,053, or 26 per cent.

After taking into account miscellaneous income debits and credits and providing for interest and reserve for replacements, the net income deficit for the year was $3,737,149, as compared with $4,874,293 in 1939, showing an improvement of $1,137,144.

The harbours of Halifax, Saint John, Chicoutimi, Quebec, Three Rivers, Montreal and Vancouver had aggregate operating revenues of $10,034,760, as compared with $8,486,475 in 1939, an increase of $1,548,285, or 18 per cent. Expenses of administration, operation and maintenance increased from $3,910,164 in 1939 to $4,211,597 in 1940, or by $301,433, nearly 8 per cent. Operating income was $1,246,852 greater than in 1939.

After taking into account miscellaneous income charges and providing for interest and reserve for replacements, a net income deficit of $4,006,837 was shown in 1940, as compared with $5,134,029 in 1939, an improvement of $1,127,192.

Capital Expenditure

Expenditures on fixed assets charged to capital during 1940 amounted to $492,044. An additional sum of $113,539, charged to replacement reserve, was expended on replacement of physical assets, the total outlay being $605,583, as follows:

		$
Capital—		
Halifax		173,268
Saint John		46,032
Quebec		7,586
Montreal		161,881
Churchill		815
Vancouver		102,462
		$492,044
Replacement of Physical Assets—		
Halifax	49,549	
Montreal	63,990	
		113,539
		$605,583

The expenditures charged to capital are financed by advances from the Dominion Treasury, on which interest at the rate of 3½ per cent. per annum is charged.

Engineering Works

The following extracts relate to works of improvement and replacement at the respective ports:—

Harbour of Halifax

During the year total expenditures on capital and replacement works amounted to $222,817, the following constituting the principal items:

Reconstruction Grain Shipping Gallery 24.—Work on the contract for reconstruction in steel and concrete of Shipping Gallery No. 24 was commenced in 1939. The gallery was first used for shipment of grain on February 17th, 1940, and all contract work was completed May 30th, 1940.

Cold Storage Annex.—In 1939 a contract was awarded for the construction of a four-storey, reinforced concrete and timber annex to the Cold Storage Terminal to be used for the freezing and storing of bait fish and fish food products. The contract was completed in May, 1940.

Additional Equipment for Cold Storage Power House.—An inter-cooler and oil trap in the ammonia piping system of the Cold Storage Terminal power house were installed together with neces-

National Harbours Board of Canada—continued

sary piping and auxiliary equipment. A motor driven centrifugal pump of 1,600 gallon capacity was also installed, with the required piping and valves, to ensure an adequate supply of salt water for the ammonia condensers.

Equipment for Cold Storage Annex.—Equipment for the handling of bait fish in the Cold Storage Annex was provided, including wooden trays for the sharp freezers, floor racks for the storage room, metal lined chutes, warehouse trucks, wash tanks, wash water pump, concrete slab at dock side, receiving hopper, rubber hose and valves.

Harbour of Saint John

During the year expenditures amounting to $227,664 were made from funds provided under the War Appropriation Act, 1940, the following constituting the principal items:—

Dredging Courtenay Bay Entrance Channel.—The contract which was awarded in October, 1939, was extended and another contract was awarded in June for dredging the entrance channel to Courtenay Bay to a depth of 17-ft. below extreme low water and for a width of 500-ft., with an additional width of 450-ft. at the dry dock entrance, to form a turning basin. Dredging was completed in August.

Dredging Dry Dock Fitting-out Berth at Courtenay Bay.—The contract that was awarded in October, 1939, for dredging the entrance channel to Courtenay Bay was extended in June, 1940, to include the dry dock fitting-out berth to a depth of 32-ft. below extreme low water, a width of 150-ft. and a length of 850-ft. Rock was encountered above 32-ft. depth. Dredging of all material, except rock, to the required depth was completed in August.

Dredging Rock from Dry Dock Fitting-out Berth.—In order to clear the dry dock fitting-out berth of rock obstructions encountered during dredging operations, a contract was awarded in September, 1940, for dredging solid rock and other materials from this area to a depth of 32-ft. below extreme low water. Work under this contract was not completed at the end of the year.

Harbour of Quebec

Ordinary maintenance and repairs were carried out during the year at a total cost of $138,766. The larger items were the renewal of face brick of part of the north and east walls of the cold storage main warehouse and the entire east wall of the cold storage refrigeration plant; reconditioning three Gurney elevator scales; replacing metal siding on part of the grain shipping galleries; major repairs to three sheds, including roof repairs, replacement of metal siding and painting; repairs to gate at the entrance to Inner Basin, Princess Louise Docks; repairs to floating crane, deck scow and derrick scow and dredging of the Custom Pond.

Harbour of Montreal

During 1940 ordinary maintenance and repairs were carried out at a total cost of $525,064, excluding maintenance on Jacques Cartier bridge on which $27,503 was expended.

The larger items were filling depressions at Bickerdike Pier; repairs to Marine Tower Jetty at elevator No. 2; resurfacing portion of retaining wall at Market Basin, section 20; resurfacing of lower floors of sheds 3 and 7; interior painting of sheds 14 and 15; exterior painting of sheds 26, 27, 44, 45, 46 and 47; renewing decking on three railway bridges over Victor Street subway; and all electrical, mechanical and floating equipment was maintained in good operating condition.

During the year total expenditures on capital and replacement works amounted to $225,871, the following are the chief items:—

Dredging.—In order to make the wharf leased to Canada Cement Co. available for 30-ft. navigation, and the wharf leased to Imperial Oil, Ltd., usable by tankers with a load draft of 32-ft., and to complete the dredging of Windmill Point basin for a usable draft of 30-ft., dredging in these areas was carried out during the year.

Strengthening Wharf, Sections 23 and 24.—In 1939 a contract was awarded for strengthening wharf, Sections 23 and 24. The major part of the work was completed during that year and the balance was finished in 1940.

Filling Area in Rear of Wharf, Sections 46 to 49.—In 1939 the construction of wharf at sections 46 to 49 was completed, and the filling of the area in the rear with material dredged from the harbour was done in part. During 1940, filling was practically completed, leaving 15.000 cubic yards to be placed in 1941.

Filling Area in Rear of Wharf, Sections 99 and 100.—Levelling of the fill placed during 1939 in the rear of the wharf leased to McColl Frontenac Oil Co., was completed in 1940.

Extension to Shed 27A.—In order to accommodate increased traffic, the construction of a 60-ft. extension to shed 27A, which is a metal sheathed, single deck structure with steel frame, was carried out partly by contract and partly by the Board's forces.

Fifteen-ton Elevator in Shed 9.—A contract was awarded in January, 1940, for the construction of a 15-ton freight elevator. This was completed in all essential details prior to the opening of navigation and was entirely completed in December.

Harbour of Vancouver

During the year ordinary maintenance and repairs were carried out at a total cost of $65,235, excluding maintenance of Second Narrows Bridge on which $10,729 was expended. The larger items were the replacement of the south end of the float at the fish dock; renewal of roofing, downspouts and gutters at shed No. 1, Lapointe Pier; renewal of sheathing of No. 1 elevator grain galleries; repairs to railway trackage; renewal of door guides and flashings, Ballantyne pier sheds; repairs to Dunlevy Avenue Wharf; widening the north approach roadway to Second Narrows Bridge and construction new toll booths and repairs to the No. 1 elevator electrical system.

The expenditure charged in 1940 to capital amounted to $102,462 and related to repairs, alterations, additions to and acquisition of Columbia Elevator. The elevator was acquired and the work practically all completed in 1939.

Port of Wellington Annual Report

Trade and Shipping

The annual statement of accounts of the Wellington Harbour Board, New Zealand, for the financial year ended 30th September last, shows that the quantity of cargo handled was 2,078,725 tons, a decrease of 12 per cent. over the return for the previous year, while shipping arrivals amounted to 3,801,034 net tons, a decrease of 6.2 per cent. There was a financial loss of £7,605 on the year's working as compared with a surplus of £13,465 in the previous year.

Harbour Improvement Works

The concreting of the Thorndon breastwork was completed early in March, 1940, providing ocean berthage of a total length of 3,680-ft. Owing to the difficulties and increased cost under war conditions of obtaining the necessary materials, the spring fendering of tne northernmost 300-ft. and the railway sidings and crane track for about 1,000-ft., will not be completed in the meantime. With the exception of the bitumen floor covering, Store No. 49 at the southern end of Aotea Quary was completed by the end of February, 1940, and prior to that date had already been used to some extent for the reception of cargo. The paving of the floor was delayed due to the late arrival of the material, but was completed before the end of June. The electric overhead travelling cranes for the interior of the store began to come to hand in October, 1939, and the last was received in February, 1940. By the middle of May all had been erected by the Board's staff and passed for use by the inspection of machinery department.

Considerable delays were experienced in the manufacture of the six 3-ton electric semi-portal cargo cranes for the berth alongside Store No. 49. Though it had been hoped that the first shipment would be received during October, 1939, it was not until September, 1940, that the gantries of the first two cranes, and sufficient parts to make one complete crane, came to hand.

Use of Floating Dock.

During the year the floating dock was used by 37 vessels, of which six were the Board's own floating plant; the number of outside vessels was therefore 31, as compared with 32 last year. The total number of days that the dock was occupied was 193½, of which the Board's plant accounted for 22½, leaving 171 days for outside vessels, as compared with 112½ during the previous year. Four vessels entered the dock for major works, occupying it for 30½, 20, 16 and 10 days respectively, and the average period that the 31 outside vessels remained in dock was 5½ days as compared with 3½ days in each of the two previous years.

The average rate paid by vessels other than the Board's plant, in dock charges and rental was 2.48 pence per ton per day, the rates during the two previous years having been 3.51 pence and 3.42 pence respectively. The earnings for the year were £14.275 13s. 11d., compared with £5,657 10s. 11d. for 1939, and £4,503 7s. 10d. for 1938; the working cost was £5,315 3s. 9d., compared witr £3,722 3s. 2d. and £3,616 12s. 1d.; and the cost of general maintenance of the dock itself was £2,584 10s. 5d., compared with £3,244 12s. 11d. and £2,768 15s. 10d.

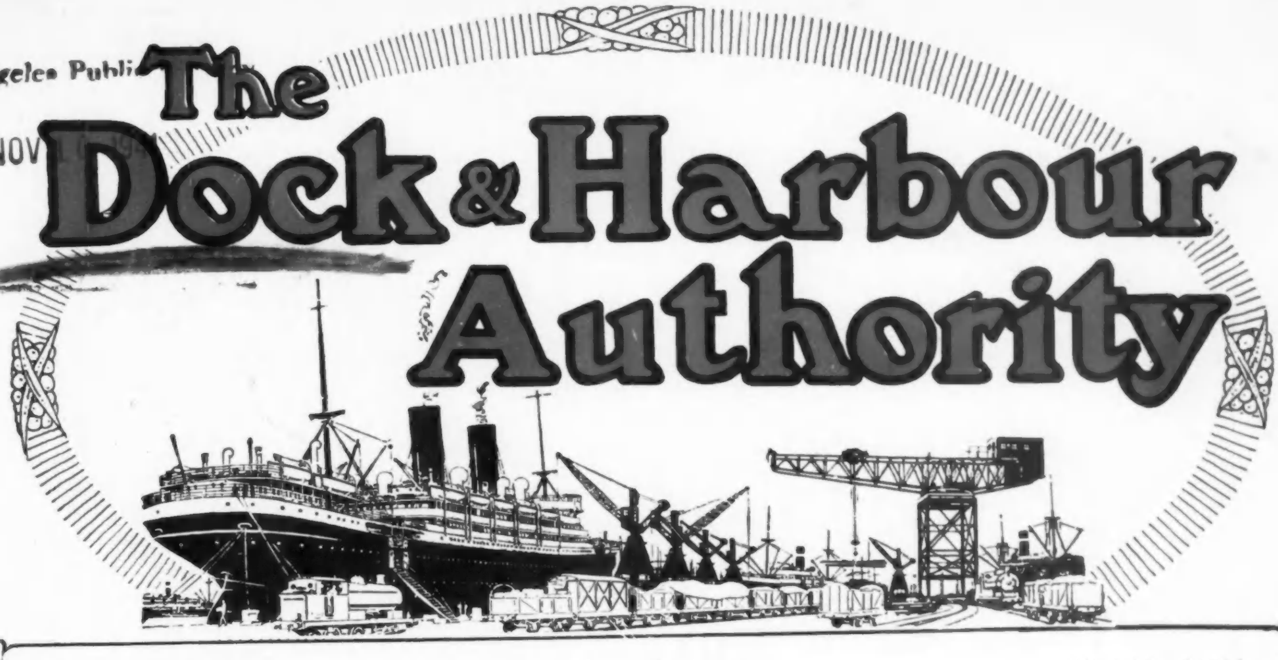
Cold Storage Facilities

(Concluded from page 226).

tered when handling by the railroads. It was felt that this was due to the fact that the fruit was kept at a uniform temperature throughout the ocean trip instead of there being the expected variation due to the intermittent icing programme necessary in the transcontinental rail trip.

It would seem to me that although cold storage facilities should be a necessary adjunct of any Pacific Coast port which has a tributary territory providing fresh fruits, that at the same time the major disadvantage is that our larger domestic market is still practically entirely shut to us as a port movement, and will remain so until the above-mentioned conditions change. This would seem to me to be one of the major questions involved in consideration of the desirability of provision of ship-side cold storage on the west coast.

The Dock & Harbour Authority



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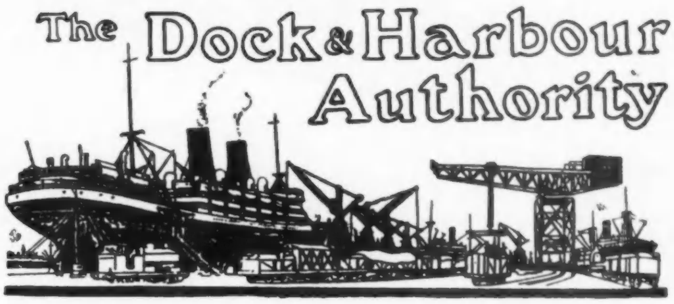

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